R842-05 ERIC REPORT RESUME

ED 010 260 2-28-67 24 (REV)
A SYNTHESIS OF RESEARCH PERTAINING TO SCHOOL BUILDINGS CONDUCTED BY EDUCATORS AND ARCHITECTS.
NORTH, STEWART D. * AND OTHERS
XY081677 UNIVERSITY OF WISCONSIN, MADISON
CRP-S-356
BR-5-8173
- -66
EDRS PRICE MF-$0.45 HC-$11.60 290P.

*SCHOOL BUILDINGS, *RESOURCE MATERIALS, *SURVEYS, PERIODICALS, BOOKLISTS, *SCHOOL PLANNING, SCHOOL ARCHITECTURE, *MATERIAL DEVELOPMENT, EDUCATIONAL FACILITIES, BIBLIOGRAPHY, MADISON, WISCONSIN

THE FIELD OF SCHOOL PLANT PLANNING RESEARCH WAS SURVEYED TO DETERMINE THE SOURCES OF RESEARCH MATERIALS. THE SOURCES INCLUDED (1) DOCTORAL DISSERTATIONS, (2) LIBRARIES AND COLLECTIONS, AND (3) PERIODICAL LITERATURE. THE STUDY FOCUSED ON SCHOOL FACILITIES AS THEY RELATE TO THE LEARNING PROCESS. SINCE LIBRARY COLLECTIONS WERE FOUND INADEQUATE, IT WAS DECIDED TO SEARCH PERIODICAL LITERATURE AND DISSERTATION ABSTRACTS. PERIODICAL ARTICLES LISTED IN THE "EDUCATION INDEX" AND THE "ART INDEX" WERE SURVEYED. ALL ARTICLES SELECTED WERE COMBINED INTO AN EXTENSIVE BIBLIOGRAPHY OF 2,188 ENTRIES. THE LITERATURE WAS SORTED, REPORTED FOR EACH DISCIPLINE, AND DISPLAYED ON A BAR GRAPH. THERE WAS A TREND FOR SCHOOL PLANT ARCHITECTS TO WRITE ARTICLES FOR EDUCATIONAL PERIODICALS. ONE OF THE RECOMMENDATIONS WAS THAT MORE DISSERTATIONS AND GRADUATE DESIGN PROJECTS BE PUBLISHED IN PROFESSIONAL JOURNALS OF BOTH FIELDS. (RS)

ED010260

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A SYNTHESIS OF RESEARCH PERTAINING TO SCHOOL BUILDINGS
CONDUCTED BY
EDUCATORS AND ARCHITECTS

COOPERATIVE RESEARCH PROJECT NO. S-356

Stewart D. North
Grantee

Ross R. Papke
Investigator

Dean W. O'Brien
Editor

University of Wisconsin
Madison, Wisconsin
1966

The research reported herein was supported by the Cooperative Research Program of the Office of Education, U. S. Department of Health, Education, and Welfare.

ACKNOWLEDGMENTS

This effort is highly indebted to the following for their various contributions toward the presented endeavors:

The faculty and the advanced graduate students of the Department of Educational Administration at the University of Wisconsin. Professors Russell T. Gregg and John Helling in particular for help with the instrument and other problems of the study.

Mrs. Carolyn Martin and Mrs. Nean Papke for mechanical assistance and a great deal of patience.

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CHAPTER ONE

INTRODUCTION

For a considerable period of history, school plant architecture underwent little change. During the past two decades, however, the educational program and the physical plant to house it underwent rapid and often undirected change. While there were some indications of the coming changes before 1942, the majority of the changes resulted from educational developments and methodologies that emerged after World War II.

In character with previous architectural developments, however, the recent changes, while rapid, have been largely derivative. That is, they have been readjustments of traditional architecture rather than direct, inventive responses to changing educational needs. To this, there have been the few exceptions of leading architectural firms that are truly innovative and creative. No small amount of blame can be laid to the local building committees that demanded conventional structures with modifications only as new developments came about. In view of the increasing educational and economic pressures to which boards, superintendents, architects, and building committees are subjected, there can be little doubt as to the critical aspects of school plant decisions.

It is becoming increasingly evident that the speed of the derivative process of developing new school structures will not answer the problems created in the current educational crisis. Research is the major, if not the only, avenue for accumulating knowledge which can improve educational effectiveness and also produce favorable economic consequences. The subsequent testing, demonstrating, and disseminating of findings will flourish only if fed by a steady stream of coordinated and complimentary research activity.

Some research has been conducted but, at the present time, there is little if any coordinated effort on the part of either educators or architects to develop a pattern for research. There is, however, an increasing awareness of the problems that this lack of coordination presents. With regard to existing literature, an initial investigation indicated two basic problems:

1. While a sizable amount of literature exists, only a small amount of it may be considered generalizable research with a potential for changing the derivative nature or speeding up the process of school development.
2. Educators and architects have a significant gap to bridge between their respective concepts of research.

It was the primary purpose of this investigation to locate, identify, and synthesize the accessible school-plant research conducted by educators and architects over the past ten years and then to analyze and classify it in order to develop a framework which may be useful in giving direction to future research. In the process of analyzing and classifying the research, attention was given to:

1. The focus of the research.
2. The design, techniques, and procedures employed.
3. The individuals and agencies involved.
4. The source of support.
5. Agreement or disagreement in findings.

A secondary purpose of the study was to present a classified bibliography of the literature that was not included as research in this study.

Background

The physical plant facilities in elementary and secondary education have been playing an increasingly influential role in American education since the end of World War II. From all indications, this increasing influence will continue into the foreseeable future, with school plant decisions being critical to the educational and financial welfare of communities, states, and the nation. At the present time, school building structures are generally expected to have a depreciation span of at least forty to fifty years, or well into the 21st century. Unless some presently unheralded development drastically changes the building industry, school plants being planned and constructed today will be likely to have long-lasting impact on the educational opportunities afforded students and, consequently, on the very productivity of society. Unfortunately, these decisions often are made in the absence of available knowledge or even with indifference to it.

The problems of physical plant planning are not new problems. Books and articles dealing with physical plant planning problems date from before the Civil War.[1] The problems at that time, while not nearly as complex as those of today, were not a great deal different; they included size, cost, heat, light, sound, the use of space, and many of the other construction and maintenance problems which still exist. While educators sought solutions to the problems of that day, not a great deal of change was effected, and, for all but a few school buildings, school architecture remained rather constant from decade to decade down to World War I.[2] In defense of these schools it must be said that they probably filled the needs of their day. Referring to the Skinner Elementary School, which was built in 1859, Chicago's Superintendent of Schools, W. H. Wells, on March 3, 1860, said:

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[1] William A. Alcott, Essay on the Construct of Schoolhouses, to which was Awarded The Prize Offered by the American Institute of Instruction, August, 1831, Boston: Hilliard, Gray, Little and Wilkins, 1832; and, Henry Barnard, School Architecture; or Contributions to the Improvement of Schoolhouses in the United States, Cincinnati: A. S. Barnes & Company, 1848.

[2] For a discussion of early schools, see John McGrath and Leo E. Buehring, "100 Years of School Plant Design," The Nation's Schools, 59: 50-58 (January, 1957).

> I believe no better models can be found than those of the Skinner; I trust, however, that the city will never build houses /schools/ so large as these from choice. I trust it will not be long before we shall have the means of building houses only three stories high /Skinner had four/ with accommodations for /only/ about six hundred pupils.[3]

In its report for the same year, the Chicago Board of Education referred to the Skinner and another school as:

> ...models for buildings affording such accommodations. The arrangements for ingress and egress are ample; in all of the twenty rooms the light is abundant and admitted on two sides; the halls and stairways are spacious and well lighted, and the means of ventilation seemingly perfect. In short, the whole arrangement leaves little room for improvement.[4]

Between World War I and World War II a somewhat improved building style prevailed. A considerable number of structures of this style, as well as many pre-World War I elementary schools, still serve communities throughout the country. Many school boards and school administrators have experienced the nearly impossible problems involved in trying to conduct emerging educational programs with these structures as they are or in trying to modify them for current educational innovations. In a relatively short span of time those persons involved in school plant planning and construction have had to travel from a period of practically no change to a period in which design and function are in danger of becoming outdated between the blueprint stage and the end of construction.

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[3] Ibid., pp. 53-54.

[4] Ibid.

School plants can promote and facilitate or limit and obstruct effective learning and teaching. The educational implications are of prime concern to all consumers of educational services. For most school systems, about 70 per cent of the budget is devoted to instruction; about half of the remaining 30 per cent is allocated to the provision of facilities. The economic impact is of concern to all citizens and taxpayers. Two and three-tenths billion dollars was spent on school construction in 1963--down from $2.6 billion in 1962. Seventy per cent of the total was devoted to new construction and thirty per cent for additions; $1.5 billion of the sum was allocated to secondary schools. In terms of school districts and buildings during 1963, 2900 school districts completed schools. In the nation as a whole, nearly one out of every four school districts completed some construction during 1963. More than 4,600 projects were reported. Almost all (96.5 per cent) of the larger districts (25,000 or more pupils) completed some kind of school construction. The average cost per classroom rose from $39,000 in 1962 to $41,200 in 1963. This rather sharp increase was due to a combination of rising construction costs and, significantly, the increased use of special purpose areas.[5] In light of the amount of construction and the costs involved, it is understandable that the taxpaying citizen is interested in obtaining the most educational value for his economic investment and that he wants to be sure the buildings are designed for the latest instructional innovation. Since the taxpayer has observed the recent rapid educational change, he is also concerned that his new construction should not soon go out of date from an educational standpoint.

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[5] "Current Trends in School Facilities," School Management, 8(2): 92-125 (July, 1964). Figures are based on all school districts of 300 students or more, 100% response; 11,911 districts were involved. Figures were compiled by

There seems to be little doubt that in the future both public education and school architecture will be characterized by rapid developments--designed and controlled, or not. Speaking to the National Council on Schoolhouse Construction in 1964, one of the outstanding authorities on school architecture, William W. Caudill, pointed out that:

> technology is not strong enough to shape a schoolhouse because education always overrides these /technological factors/. . .education is going to change, and change radically. If it does, it is going to be hard to recognize a schoolhouse and, believe me, this organization /NCSC/ is going to have to change its books so fast that you will have to have three or four publications committees; one for twenty years from now, one for ten years from now, one for five years from now, and one for next year.[6]

(Footnote 5 continued) Management Publishing Group Reports, a division of School Management. The 1964 information, less complete, shows building at $2.5 billion and a total of 4,951 projects reported. The use of special facilities decreased in 1964 except in new secondary school buildings. The 1964 figures indicate an upward trend after a falling off from 1962 to 1963.

[6] William Caudill, "Trends in School Building," in National Council on Schoolhouse Construction, Proceedings of the Forty-First Annual Meeting, East Lansing: The Council, 1965, p. 41.

There appears to be instances of good collaboration between educators and architects--in some organizations, some architectural firms and consultant firms, and at some educational and research institutions. By and large, however, there has not been a lot of cooperative effort and, to some, there appears to be a gulf. It was not until October of 1965 that the National Council on Schoolhouse Construction voted to change its membership requirements to admit architects and then only on an architectural firm membership basis rather than as individual members. This appears to be an effort on the part of educators to bridge the gap. Frank G. Lopez, a prominent authority in the field of school architecture, writing a short report of the 1956 AASA convention, felt that "the respect the educators generally tendered the architects was impressive", but that things did not really go very well. While given charge of some entire sessions and participation in others," the architects . . . had muffed their one big opportunity, the discussion meeting on school architecture. They spoke up at others with, generally speaking, less strength than the respect accorded them led one to anticipate."[7]

Research conducted by educators with respect to the school plant has, generally, ignored related research by architects and persons in associated technical fields. A pilot study of available research also supports the converse:

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[7] Frank G. Lopez, "Thousands of Schoolmen, a Handful of Architects," Architectural Record, 119(2): 28 (April, 1956).

that there has been little effort by architects to relate to or build on the findings of educators. Hence, it appears that there may be an unwarranted lack of coordination and a consequent dissipation of resources. The nature of school plant problems and issues, and their relationship to learning, support the need for an interdisciplinary approach to these vital topics. Similarly, there is a need to integrate in school plant research the human factors--social, psychological, educational, etc., as well as the physical factors--thermal, visual, sonic, etc.

Preliminary investigation of the research carried on by staff and students at major universities over the past half century reveals that the research concerning the school plant has been limited in scope and approach. And it was only within the last few years that research relating specific environmental factors to the learning process made a notable appearance in Dissertation Abstracts or that "Environment" appeared as a heading in the Education Index.

The school plant planning field is not abundantly endowed with bibliographical references. Early bibliographies were highly specialized, principally in the field of finance. The first notable bibliography dealing principally with school plant planning was by Fowlkes and Carlile.[8] It was published by the Bureau of Educational Research at The University of Wisconsin in 1925 and contained 408 references to magazine articles and 69 references to books, bulletins, pamphlets, and scorecards.

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[8] John Guy Fowlkes and A. B. Carlile, Bibliography on School Buildings, Madison: University of Wisconsin, Bureau of Educational Research, 1925.

From 1928 to 1945, the Bureau of Cooperative Research at Indiana University[9] published a series of six bibliographies on school buildings, grounds, and equipment totalling nearly 7,100 briefly annotated references.

A study by Sol Levin[10] was the first locatable bibliographical work at the doctoral level. The Levin study was done in 1952 and included more than 1200 references which were grouped into as many categories as possible. While the Levin study was aimed at and based upon the school business manager's job, several of the major categories pertained to the school plant and to the school plant planning field. Interestingly, Levin selected his references on the basis of the following criteria: 1) authoritativeness; 2) comprehensiveness; 3) recency; 4) accessibility; and, 5) particular recommendation by other references, bibliographies, or persons consulted. The Levin dissertation was published in 1953 by the American Association of School Business

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[9] H. L. Smith, L. M. Chamberlain, and Others, A Bibliography of School Buildings, Grounds and Equipment, Volume IV, No. 3; Volume IX, Nos. 2 and 3; Volume XI, No. 2; Volume XXI, Nos. 2 and 5, Bloomington: Bureau of Cooperative Research and Field Service, School of Education, Indiana University, 1928-1945.

[10] Sol Levin, "A Practical Bibliography of Business and Plant References for the School Administrator," (unpublished Ed.D. dissertation, Teachers College, Columbia University, 1952).

Officials of the United States and Canada.[11]

Another investigator who included school plant in his research classification was Harris A. Taylor,[12] who wrote his dissertation in 1954. Taylor classified doctoral dissertations according to thirteen problem areas, which he subjected to a paired comparison instrument as a part of his effort to ascertain research needs as perceived by professors of school administration and by professional school administrators. He further attempted a comparison of perceived research needs with an analysis of problem areas investigated in doctoral dissertations in the field of school administration from 1945 to 1952. Taylor found that research priorities of professors generally agreed with those of school administrators; disagreements were found in some areas.

In a dissertation at the University of New York in 1956, Whigham[13] worked out a synthesis of factors in school plant planning. He developed a theoretical guide to educational planning for school plant construction by analyzing the related literature, by studying the planning experiences in fifteen school systems, and by utilizing judgments from a selected group of authorities.

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[11] Sol Levin, A Practical Bibliography of Business and Plant References for the School Administrator, Kalamazoo, Michigan: The Association of School Business Officials of the United States and Canada, 1953.

[12] Harris A. Taylor, "An Analysis of Doctoral Research Problems in School Administration" (unpublished Ed.D dissertation, Stanford University, 1954).

[13] Edward L. Whigham, "Educational Planning for School Plant Construction," (unpublished Ph.D. dissertation, University of New York, 1956).

In 1958, Collins,[14] at Columbia, undertook an analytical review of selected doctoral dissertations and projects on school plant planning and design. His study was designed to bring together in one publication a list of American doctoral theses relating to school plant planning from 1912 to 1957, to point out the strengths and weaknesses of the overall pattern of completed doctoral theses in school plant planning and design, and to recommend promising directions for future doctoral theses in school architecture. Collins worked out a rather elaborate code for classifying the dissertations. He reviewed nearly 16,000 theses, of which 911 were classified by the coding system as applicable to school plant planning. In addition, Collins utilized three categories of pertinence: directly related, a part of the thesis devoted to the code described, and implications for the code description assigned.

The need for the study here proposed has been pointed out by Griffiths, who stated:

> One of the kinds of research most needed at this time is a set of reviews of the literature in particular areas, such as school buildings, morale, merit rating. Each of these reviews would report the research done on each topic, synthesize it in terms of an explicit framework, report the generalizations of value to researchers and practitioners,

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[14] George J. Collins, "An Analytical Review of Selected Doctoral Dissertations and Projects Undertaken in American Colleges from 1912-1957 on School Plant Planning and Design with Proposals for Further Research (unpublished Ed.D dissertation, Columbia, 1958).

> and indicate the kinds of research needed to be done together with an estimate of priorities.[15]

Basic to such action are, first, the creation of a system of classifying data in a meaningful manner (which now appears to be noticeably lacking) and, eventually, the development of a taxonomy. While few taxonomies have much potential for being developed into theories, some of the taxonomic approaches to theory development may form a useful structure in moving school plant research forward. Griffiths has incorporated the levels of stages of the development of a theory in a paradigm[16] which may prove useful in the eventual development of such a structure for research. Stodgill's[17] evaluation of investigations of personal factors associated with leadership and the analyses of decision-making research by Rossi[18] and Edwards[19] are representative of efforts made to synthesize and compile research findings into a structure useful for the development of a theory or for the guidance of further research. Homans[20] made some suggestions on theory building that would also apply to the development of a taxonomy of school plant research. He suggested examining the obvious and familiar, choosing words that distinguish between categories, and limiting the categories to the smallest possible number.

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[15] Daniel E. Griffiths, Research in Educational Administration (New York: Bureau of Publications, Teachers College, Columbia University, 1959), p. 55.

[16] Daniel E. Griffiths, "Nature and Meaning of Theory" in Behavioral Science and Educational Administration, Daniel E. Griffiths, ed., (NSSE 63rd Yearbook, Chicago: University of Chicago Press, 1964), pp. 104-5.

[17] Ralph Stodgill, "Personal Factors Associated with Leadership," Journal of Psychology, 25: 35-71 (1948).

[18] Peter N. Rossi, "Community Decision Making," Administrative Science Quarterly, 1: 415-43 (March, 1957).

[19] Ward Edwards, "The Theory of Decision-Making," Psychological Bulletin, 51: 380-417 (1954).

In developing a classification scheme of the research about school plant planning by two groups with such diverse approaches as those exhibited by educators and architects, it is essential, in so far as possible, to utilize an interdisciplinary approach. In deploring the fact that there are apparently several specialized kinds of administration but seemingly little that can be agreed to under the general topic of administration qua administration, Litchfield has stated that "the most serious indictment which must be made of present thought is that it has failed to achieve a level of generalization enabling it to systematize and explain administrative phenomena which occur in related fields."[21] School plant research should emerge from the same state of insularity which has characterized education generally and should manifest, instead, an integrated approach. The 1964 NSSE Yearbook demonstrated the trend toward utilizing pertinent research of the behavioral sciences to illuminate educational problems. In addition, it was pointed out in Chapter One of the yearbook that educational administrators are interested in efforts to determine the generalizable factors of administration from the specialized fields of administration. It is further pointed out in this respect that there is more commonality than differentiation in administrative practice.[22] There is little reason to suspect that commonality is any less characteristic of architectural and educational research.

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[20] George C. Homans, The Human Group (New York: Harcourt, Brace and Company, 1950), pp. 16-17.

[21] Edward H. Litchfield, "Notes on a General Theory of Administration," Administrative Science Quarterly, 1: 7 (June, 1956).

Statement of the Problem

The following questions formed the basis for this investigation:

1. What is the nature of the research in school plant design which has been conducted by educators and architects during the decade 1955-1964?
2. What are the patterns of strengths and weaknesses of existing research by educators and architects and how may their identification be utilized to give appropriate emphasis and direction to future research endeavors?
3. Does an analysis of the basic patterns and relationships of existing school plant planning research by educators and architects suggest a logical and

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[22] Daniel E. Griffiths et al., "The Theme" in Behavioral Science and Educational Administration, Daniel E. Griffiths, ed., (NSSE 63rd Yearbook, Chicago: University of Chicago Press, 1964), p. 3.

useful classification of such research?

As a part of the study, the research relationships of educators and architects were noted to determine the extent to which each has utilized the research findings of the other.

Procedure of the Study

The basic procedure followed in this research was to locate, classify and evaluate both the socio-psychological and the technical aspects of school plant development as revealed in the research literature. An attempt was made to accomplish this purpose by dealing with the research of both educators and architects which relates to the quality of the environment provided for the learning process. The plan for the study was based on the premise that all major relevant research with reasonable accessibility would be listed in the standard references to periodical literature. More specifically, the procedure of this research was to:

1. Locate and identify the school plant literature reported during the ten-year period 1955 through 1964 in American periodicals;
2. Identify by instrument those items in the literature acceptable as research endeavors;
3. Classify the research in such a way as to reveal the initial stages of a taxonomy of school plant research;
4. Analyze and interpret the existing research, noting

inadequacies regarding its nature and techniques;

5. Report and relate the findings in a manner useful to educators, architects, and related technicians; and
6. Compare the research methods and findings of the two fields as to cooperative effort, overlap or duplication of effort, and similar and dissimilar findings.

The initial procedure undertaken in this study was to locate the appropriate periodical literature in the fields of education and architecture. Since the study was designed to emphasize utilitarian value, the research should be reasonably accessible to be of use. Two major periodical indices were used: the Education Index, the major reference guide to periodical literature in the field of education, and, the Art Index, which cites from all of the periodicals pertinent to the field of architecture. These two bibliographical references were analyzed under all appropriate major headings and subheadings and all school plant titles were placed on reference cards. All such titles, even though they were unclear as to content or otherwise in doubt, were recorded during the initial screening.

To evaluate completeness, a search was also conducted utilizing several standard references and bibliographies which include the field of school plant planning. These references were: the Review of Educational Research, the Encyclopedia of Educational Research, the 1964 NCSC

Proceedings, BRI School Building Research, and the AIA Research Survey. Also included in this search were the reports and publications of known research centers or institutions, such as the Educational Facilities Laboratory; the Texas Experimental Station; Caudill, Rowlett, and Scott; the School Construction Systems Development Project; and the Cooperative Research Program of the United States Office of Education. All titles were placed on reference cards. These titles were cross referenced against those reported in the periodical indices to disclose whether or not major gaps or oversights existed and, in the event that they did exist, to form the basis for evaluating and reporting the problems of coverage.

The second step was to reduce the references to those which met specific criteria. All reference cards were placed in chronological order by periodical (excluding any periodical with fewer than three references) and each reference was quickly scanned by the researcher and accepted or rejected as an appropriate research report on the basis of the following three criteria:

1. The reference must bear a relationship to the quality of the environment which is provided for the learning process.
2. The reference must be acceptable as research according to the instrument designed for that purpose for use in this study.[23]

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[23] See Chapter III.

3. The research in the original form, or a summary in adequate detail, must be published in such a manner as to be available to the practitioner and to the researcher.

All literature (such as doctoral dissertations) deriving from work conducted under conditions acknowledged to be acceptable for research was included provided it met criteria one above.[24]

The reported research was examined in terms of:

1. The Problem
    a) motivating factor
    b) focus
2. The Design
    a) methods of research
    b) population
    c) techniques of collecting data
    d) statistical methods
3. Findings and Conclusions
    a) nature of the findings
    b) agreement or disagreement between educators and architects
    c) generalizability
    d) implications

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[24] For the purpose of this study, all dissertations listed for the period under consideration in American Doctoral Dissertations will be included in the classified bibliography, however, only those dissertations that are also abstracted in the Dissertation Abstracts will be treated with the research disclosed in the periodical literature.

4. Sources
    a) researcher
    b) institution or place
    c) support

A checklist based on the above classification scheme was utilized.[25] Through logico-deductive analysis of the data, an effort was made to determine suitable categories of classification. Existing research was placed in the appropriate classification categories and an overall evaluation of the research available in the various categories was attempted. Strengths and weaknesses of the research were noted for the purpose of indicating categories or problem areas needing the attention of future research efforts.

The present study was limited to research reports that are reasonably available, either in the original or in useable reported form. It is probable that there is a fair amount of research that has not been reported at all or has been released in only limited distribution. This appears to be particularly true in the field of architecture.[26]

Limitations of the Study

The limitations of this study include the following:

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[25] See Appendix "A".

[26] Benjamin H. Evans, "AIA Research Programs," American Institute of Architecture Journal, 41:58 (January, 1964). "Unfortunately, most of those who are doing research cannot afford to distribute copies of their reports to the entire profession, and consequently, the results of their efforts go unnoticed by the majority."

1. This study necessitated the rapid disclosure of pertinent periodical works in a minimum span of time. As a result, it is possible that the tools and measures of the screening system may have overlooked a few items of research that might be included by other researchers. The procedure utilized to locate the major research represents an attempt to include as many relevant works as possible, recognizing that it is not possible, in a single one-year study, to conduct a comprehensive open-ended search.
2. This study involved a degree of subjectivity which was unavoidable. It was not possible to evolve a definition of research that could be applied objectively to both education and architecture and that would prove to be functional when applied in all operational situations. This problem was even more of an enigma to the educational researcher when working in the field of architecture than when he was working in the field of education. A publication was accepted or rejected as a report of research entirely on the basis of whether or not it met the criteria of the instrument; it will be left to the user of the report to determine whether the data have any value for his particular use.
3. This study can only represent a beginning of the work needed in this field of endeavor. It is hoped that further work of this nature will lead eventually

to the development of a fullblown taxonomy, and perhaps to the formulation of functional theoretical constructs useful to future researchers. Prerequisite to these developments, however, is the formulation of a beginning system of classification, which is perhaps as far as this study can be expected to advance the process.

Organization of the Study

This study will be reported in six chapters. Chapter One presents an organizational overview of the work done, including the purpose of the study, a statement of the problem, background information, the procedure of the study, and the limitations of the study. Chapter Two discusses the nature of school plant research from the architectural standpoint and from the educational administration standpoint, and it attempts to explain past and present relationships between architects and educators. Chapter Three presents the instruments and checklists used in the study. Chapter Four presents and evaluates the research studies located in the educational periodical sources. Chapter Five presents the same treatment of studies from the architectural periodical sources. Chapter Six presents a summary of the data from both educational and architectural sources, attempts to develop a classification system, and presents an overview of needed research in the school plant field.

CHAPTER II

BACKGROUND OF SCHOOL PLANT RESEARCH

Man has been investigating his surroundings and seeking to improve them for as long as he has inhabited the earth. And his investigations have led to a degree of control over certain features of his earthly surroundings. At the present time, he is extending his efforts at control to the areas beyond the planet he inhabits, primarily because he has perfected the requisite tools and equipment. He has arrived at his present state of space-age sophistication and is continuing to advance his progress toward the moon by means of research. It has often been estimated that man has made more scientific progress in the "space years" than he achieved in all the previous years.

Yet there are many areas in which man has not made such startling and evident progress. There are, in fact, some areas in which he has made little or no progress at all. Current advancements in man's knowledge, if plotted by area, would range along a continuum from no progress to spectacular space progress.

Man's levels of achievement in improving the physical and environmental conditions within which he houses his children for the purpose of educating them likewise occupy varying positions on a continuum. This continuum would range from the one room shack to the latest edifice promoted as the space-age school.

In his book on educational research, J. Francis Rummel points out that in most disciplines, the research approach to the solving of problems has been preceded by three other approaches:

(1) Trial and error

(2) Authority and tradition, and

(3) Speculation and argumentation.

In the trial and error method, Rummel describes man as "muddling" along. As "the process of sifting out those methods and procedures that do not produce satisfactory results continues, a few principles gradually emerge." In the second stage, "leaders" of the past are quoted and people rely on tradition if they lack the time or the training to settle particular problems. In the third category, speculation and argumentation, the "authorities are frequently doubted and solutions of fact are sought through debate."[1] There is good reason to suspect that far too many local bond issues and sets of educational specifications for school buildings fall into these three categories. There is also good reason to suspect that far too many school buildings are designed by one of these three methods, particularly the first.

Research in Education

Rummel's fourth stage, research, involves the use of hypothesis and experimentation--the securing of facts and the drawing of conclusions. This stage may lead to a fifth and more precise stage if the information involved lends itself to being reduced to quantitative terms, a considerably more precise refinement of the research stage and subject to the tests of scientific analysis based upon one of the acceptable methods--experimental, historical, survey, et cetera--objective and replicable. Rummel states that the fourth stage, the scientific or research stage, may conceivably be quite inadequate without the further advancement to the interpretation and evaluation criteria of the fifth stage.[2]

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[1] J. Francis Rummel, An Introduction to Research Procedures in Education, New York: Harper & Row, Publishers, 1964, pp. 6-7.

The general format for educational research is usually not in much dispute among educators. However, there are many aspects both within and in addition to the generally accepted procedure for research on which there is a lack of agreement. The controversy about the kind and quality of research reflects one of the serious problems in education. As in most other professions, there are purists, those who would interpret research liberally, and a significant number who occupy the middle ground. Agreement over procedure for identifying research presents a more difficult problem than agreement over the procedure for pursuing research. Many reports and articles have appeared that have not followed customary research procedures but nevertheless bear many of the characteristics common to research. Classifying these reports and articles in a useful manner, widely acceptable to educational practitioners, is one of the remaining unsolved and serious research problems of the profession. This problem is further compounded by the fact that such approaches as library research, action research, and information surveys are easily confused with generalizable research. At the present time there are no widely accepted criteria as to what is and what is not recognized as research, and there is no instrument presently available that will discriminate between what is and what is not a piece of research.

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[2] *Ibid.*, p. 8.

Research in Architecture

As education is akin to the social sciences and draws on them for its methods of operating, architecture is closely related to and draws much of its rationale from the arts. In a creative atmosphere, hard and fast lines of demarcation (such as those necessary for defining and classifying research or for identifying research) are difficult to draw.

A review of the periodical literature in the field of architecture for the period under consideration reveals an increasing concern for identifying and defining research in architecture. The same review of literature also reveals that there is as much disagreement and concern over what is research in architecture as there is in the field of education. As was true of research in education, there is no standard pattern for conducting research in architecture.

In the past, the development of architectural change was primarily derivative, although there were such exceptions as Frank Lloyd Wright. However, it has only been in recent years that the concern for bypassing the derivative process has manifested itself in architecture.

Benjamin H. Evans, Director of Research Programs for the American Institute of Architects, writing in the journal of that organization, states that, insofar as the AIA is concerned, research might be classified as basic, applied and product. Evans states that "basic research might be defined as that systematic investigation which produces new knowledge and which is applicable to mankind in general." He sees applied research as research which "might involve those investigations which result in new knowledge or in the application of knowledge in new and different ways, primarily of benefit to the architectural profession." And, the term product research, according to Evans, is "self-explanatory--it deals with the development of new materials, products and systems which normally will result in salable goods."[3]

The fact that there have been numerous articles written on research in architecture by those associated with the profession and for the consumption of architects via their professional journals indicates a real concern over research. In its principal headquarters at the Octagon in Washington,

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[3] Benjamin H. Evans, "What Is Research for Architecture?," Journal of the American Institute of Architects, 41:87-88 (January, 1964).

D.C., the American Institute of Architects does maintain a section on research, with a director and a research staff. The organizational structure of the AIA provides for a committee on research for architecture. The committee on research is comprised of practicing architects. Because they are practitioners, their primary responsibility is directive in nature. The committee on research sponsors conferences from time to time.

One such conference recently took place at AIA headquarters in April of 1964. The conference was financed through supplementary dues of the AIA. Twelve of the eighteen listed participants represented institutions of higher education. Two participants were listed as private practitioners, two as representing foundations or institutes, one as representing private industry, and one who was associated with an extensive research development project. Most of the participants undoubtedly also maintained several other ties and associations with other phases of architectural practice and activities in addition to their primary professional job description.

The conference first took up the task of establishing the factors which could create a more favorable climate for research in architecture. The factors were (1) moral support from the profession, (2) personnel trained for research, (3) money, (4) communication-publication, and (5) freedom--fewer restrictions. At the end of the conference the participants were able to list means of implementing this favorable climate. They recommended a modest start toward a research publication, a forum for the exchange of ideas (both scholarly papers and informal discussions), the establishment of research as a category for AIA Fellowship, a strong policy that AIA take the lead in research, an attempt to improve the attitude in school of architecture faculties and enhance the image of the researcher in the profession, and a statement favoring government funding of specific kinds of research for architecture. The consensus of the group was that the conference was worthwhile.[4]

The consensus that the conference was worthwhile was borne out one year later at the Second Annual AIA Architect-Researchers' Conference, held on the campus of the University of Michigan. The AIA Committee on Research for Architecture, which sponsored the conference, judging from the previous year's attendance, had anticipated about 35 participants. The conference attracted 110 participants. Highlights of the conference, as observed by the assistant editor of the AIA Journal, Marilyn Ludwig, included the beginning of an interdisciplinary approach to architectural research, a recognition that there still is strong resistence within the profession to the image of the architect as the technocrat of tomorrow's society, a consensus that the profession must relinquish what one speaker termed "the Renaissance-man syndrome," a discussion of the use in research of whatever appropriate knowledge and tools are available, and disagreements over whether or not duplication of effort is a problem.

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[4] Benjamin H. Evans and Marilyn Ludwig, "AIA Architect-Researcher's Conference," Journal of the American Institute of Architects, 42:61-68 (July, 1964).

Significantly, there was little evidence of the previous year's preoccupation with defining "research for architecture" but, rather, notable concern about where tomorrow's researchers will come from. Mrs. Ludwig observed that, generally, the papers at the Ann Arbor conference were short on theorizing and long on practical application. John Eberhard, Director of the National Bureau of Standards' Institute of Applied Technology, pointed out what may be one of the basic motivating factors that will alter the traditional developmental form that architecture has followed when he said,

> New research and practice tools are becoming available at a fantastic rate. Others are learning to use them as rapidly as they are developed. . . .we have perhaps five years before technology will have passed us by--unless the architectural profession acts quickly."[5]

In general, while paying considerable attention to research for architecture over the past ten-year period, the architectural profession is more than somewhat troubled by its inability to free itself from the feeling that architecture is primarily an art--an art with strong and traditional humanistic orientation. While architecture is likely to remain an art, for the most part, it will probably have to make provision within this setting for a strong research program.

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[5] Marilyn E. Ludwig, "Architectural Research Comes of Age," Journal of the American Institute of Architects, 44:6 (November, 1965).

Background of School Plant Planning

Very little written background was located to document the historical relationship of the architect or the educator to school plant design. Obviously, the American educator's role in planning has existed since some local schoolmaster supervised the construction arrangement of the first log schoolhouse in colonial times. Equally apparent is the fact that, at some point in the evolution of the schoolhouse, the building became sufficiently complex to require professional supervision instead of local lay supervision, particularly as cities grew and schools became more than several one-room schools attached together. These professionals were the engineers and the architects or their early forerunners. As the country developed, so did the relationship between the architect and the local school authorities, becoming the architect-client relationship that exists today, although the present-day relationship has taken on many new aspects of community involvement.

According to Caudill, in spite of considerable criticism of the old school buildings, "for the most part they did a pretty good job for what they were intended to do. The reason they do not work so well today is that their job is different."[6] Caudill goes on to provide a brief survey of architectural change over the past one hundred years:

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[6] William W. Caudill, "Form Follows Function," National Education Association Journal, 46:152-155 (March, 1957), p. 153.

Let's go back a hundred years to examine some of the forces which have shaped our architecture.

In the mid-19th century, the growth of industry introduced the engineer to building. A change in architecture was inevitable. The engineer, no traditionalist, made use of the new technology to build quickly, cheaply, and efficiently.

Architects, on the other hand, were becoming obsessed with beauty. Convinced by Ruskin and Greenough of the inadequacies of classic design, they countered with a romantic kind of design, marked by "gingerbread" flourishes.

At the same time, however, in the midwest, varying social, political, and physical conditions, including the great Chicago fire of 1871, fostered change resulting in a new and meaningful architecture.

The famous "Chicago School" of architects (Richardson, Wright, Sullivan, and others) made significant advances. Challenged by America's industrial progress, they made use of the vast improvements in equipment, materials, and processes which were the products of industrial building. Their architecture possessed not an applied beauty, but an innate beauty that represented the spirit of the times.

The Chicago School did much for school architecture--it wedded common sense and creativeness to school building. Some of today's outstanding school buildings are the outgrowth of schools constructed right after the turn of the century. Bilateral and even trilateral lighting (often considered modern techniques) were, in fact, used by these men.

While American architecture in general retrogressed somewhat after the first advances of the Chicago School, school architecture drifted backwards for an even longer time. From 1915 to 1940, progress in school planning ebbed, curtailed by the enactment of restrictive codes and regulations.

This was the Dark Age of educational architecture. Laws stipulated unilateral lighting, regulated the size and shape of classrooms, even controlled the orientation of buildings. We still have some of these laws in a few of our states.

The last noteworthy movement in the advance toward modern school architecture was triggered by the famous Crow Island School in 1940, but did not gain much momentum until 1950. It finally had dawned on school architects that their real client

> was the pupil, and at last architects and educators began to work together to solve their common problems.
>
> Many conferences were held, citizen groups demanded better school buildings, and cities and states began to revise their codes. Creative architects and creative educators throughout the nation worked together to forward the cause of school children, as America took the lead in building better school plants. Children--at least a few of them--were taught in a warm, friendly, efficient learning environment.
>
> Today /1957/, thinly scattered throughout the U.S. are beautiful, functional schools serving the needs of youngsters and their learning processes.[7]

While the Crow Island School is often cited as the pilot school prior to World War II, there were a few other experimental designs in the 1940's and early 1950's both before and after World War II. As is well known, building of all kinds, including design innovations, was at a low ebb due to the war effort from 1941 to 1945. When the building industry began to recover from the war shortages, there was a considerable amount of catching up to be accomplished. Accelerating population growth was demanding additional classroom space as rapidly as possible. However, by the 1950's, considerably more attention was given to designing innovations for the educational program which was then beginning to change markedly. While the evolutionary process of changing school architecture has not been significantly altered, there have been some notable departures from the evolutionary process in order to meet the demands of an entirely different form of the educational progress.

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[7] *Ibid.*, pp. 153-154.

Transition to Research Orientation Necessary

As has been pointed out, the traditional relationship between architect and educator at the local level has been that of architect-client. This basic relationship holds for all types of building programs. By and large, this relationship has been a good one; the architect is interested in receiving the contract, thereby adding to his firm's financial gain and to its reputation, and the school authorities are interested in fulfilling the community's schoolhousing requirements. While not all building programs end on a note of harmony between the school authorities and the architect, the architect-client relationship during the planning stage is generally cooperative. The architect is recognized as an expert with special competencies necessary to the construction program, and the school authorities are recognized as spokesmen qualified to interpret the community's educational wants and needs. This same tone of planning together does not necessarily exist above the local level; at other levels, however, the relationship is likely to take the form not of vocal disagreement but of "separate tables."

It is assumed that all good architectural firms keep abreast of technological changes and incorporate new product research developments in their designs and construction specifications whether the project is a home, a factory, an office, or a school. However, there are countless aspects of schoolhousing design and changing technological educational program developments which make the resemblence of educational facilities to other types of structures superficial. It is evident that in the period since World War II these educational changes have altered drastically in two directions: (1) the spaces and facilities that they require no longer resemble traditional classrooms, and (2) the changes are coming in rapid fire succession and are not necessary evolving one from another or from a previous pattern.

Because of the nature of the construction industry--the large costs involved, the relative permanency of the materials that are used and the way they are put together, the lengthy anticipated depreciation span, and the important human resources for which the structure is designed--it is anticipated that the evolutionary approach to design by architects and the evolutionary approach to specifying the desired and perhaps even mandatory educational program by school authorities are no longer equal to the task. It will be necessary for both groups to depend upon research in their approaches to solving the schoolhousing problem.

CHAPTER III

DESIGN FOR IMPLEMENTING THE STUDY

In order to arrive at the point where it would be possible to treat the questions that form the basis for this investigation, it was necessary to make two assumptions on which two devices and an instrument could be developed to reduce the bulk of the written material in the field of school plant planning to literature acceptable as research literature. The first assumption was that the periodical literature in architecture and education represented the research accomplished in these fields; i.e., that the researchers utilized the periodical literature as a means of publicizing their findings. The second assumption was that devices and instruments could be developed to distinguish the reports of research from the rest of the non-research periodical literature.

The first assumption was based on the fact that the professional journals are one of the few means of wide news circulation in the two professions under consideration. Both professions have, or have had during most of the period under consideration, at least four widely publicized professional journals. Most of these publications have established, as a part of their dedication of service to the profession that they serve, purposes and goals that cannot be achieved other than by professional updating. The professional journals are one of the few outlets--along with books, pamphlets, and conferences--for the publication of important findings, particularly for personal advancement or for prestige. Publication is particularly important to those working in college and university surroundings, and articles on research in school plant indicate that much of the research is done at institutions of higher education. This first assumption was also based on an important consideration which stems from an initial investigation of the literature for this study; if school plant literature was to be located within the limited time and resources for this project, it would have to be initially organized through the readily available periodical literature. Original pamphlets and reports often have been produced only in limited numbers and are located in widely scattered and frequently unorganized settings in private or institutional collections.

The second assumption, that the research reported in the periodical literature could be located and identified, was based on the availability of two adequate indices--the Educational Index and the Art Index--which include not only all of the major publications in the two fields but also most of the periodicals which may be considered as lesser publications with reference to reporting school planning research. The second assumption was further based on the belief that, although research may not be defined at the operational level to the satisfaction of educators and architects, a sufficient number of essential characteristics of research could be incorporated into an instrument to enable the user to discriminate research reports from non-research reports. The objective application of basic research characteristics to discriminate research reports appeared to be an essential step for enabling future researchers to build on the classification and to update the research reports that were revealed by this study.

In order to locate, identify, and evaluate the research reports used in this study, it was necessary to develop two devices and an instrument. The first step was to develop a procedure for organizing the literature. The device needed was a card sort system to show necessary citation information and to record certain essential facts about each item of literature for easy future sorting. The second step was to select the research items from the literature. For this purpose it was necessary to design an instrument that would distinguish research reports from non-research reports. This instrument was the most refined of the three mechanical procedures devised and was validated by means of a pilot study. The third step was to evaluate the research that was revealed by the instrument. For this purpose a checklist device was designed to record a selected collection of information about each item of reported research. The checklist formed the basis for evaluating the research located in terms of problems studied, the design of the research, the findings and conclusions, and the sources of support.

The card sorting system. The first important procedure in this study was to locate the periodical literature in the fields of education and architecture and to organize an arrangement for quickly scanning it. A card sort system was considered to be the most appropriate because it would facilitate the arrangement of the periodical articles in the most convenient order for reviewing them. In addition, the cards could be re-sorted for other essential uses such as organizing bibliographies and developing a system of classification.

A four inch by six inch plain index card was used. The following information was imprinted on one side by means of mimeograph: (1) lines for the complete citation of the article, (2) blanks for a code sorting system, and (3) several labeled boxes for color smears to be used in the initial sorting.[1] The card was utilized in the following manner:

1. The complete citation information was placed on the card using one card for each reference located under all possible topics in the Education Index and the Art Index.
2. A color smear indicating the source from which the reference was obtained was placed in the appropriate box (red for the Education Index and green for the Art Index).
3. The cards were separated by periodical and all of the references within each periodical group were

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[1] See Appendix B.

placed in chronological order by date of publication and page number.

4. The articles were quickly scanned by the investigator using the instrument described below for discriminating research from non-research, and a color smear was used to record whether the article was a research (green) or a non-research article generally appropriate to school plant planning (yellow); at the same time, the background of the author was noted (red for education or related, green for architecture or related, and yellow for no author information given, author not related to either group, or no author specified), and a color notation was made (green smear in the lower right hand corner) if the article was only a description of a completed school facility or collection of completed school facilities.

The card collection was then separated into three groups: research articles, non-research articles generally applicable to the school plant planning field, and reports of completed school building projects. The latter group has often been referred to as the "how we (they) did it" reports. The cards within each group were placed in alphabetical order by author.

The instrument for identifying research. The standard publications[2] in the school-plant evaluation and planning field do not suggest any procedures for identifying research related to this field of investigation. While some published articles have suggested the need for research regarding school plant, the authors have not set forth definite criteria for such research nor have they developed checklists to apply to the research. Such well-known research sources as the Encyclopedia of Educational Research and the Review of Educational Research do not indicate the criteria by which the research reported was selected, and, indeed, often contain a considerable number of non-research items. In most cases the selection of research to be reported was left to the judgment and discretion of the person who was selected to write a particular section. The basic literature in the field of educational research did not give specific directions for determining what is and what is not research. However, the attempts made in such literature to describe the generally acceptable types of research did offer an entry into instrument development. Sections of books such as those by Best, Travers, Mouley, and others provide an informational basis for the initial development of the instrument employed in the present investigation.[3]

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[2] Examples of these publications include: Harold W. Boles, Step By Step to Better School Facilities, New York: Holt, Rinehart and Winston, Inc., 1965; Wallace H. Strevell and Arvid J. Burke, Administration of the School Building Program, New York: McGraw-Hill Book Company, Inc. 1959; and National Council on Schoolhouse Construction, Guide for Planning School Plants, East Lansing: The Council, 1964.

Two conventional ways of classifying research are (1) the basic and applied research distinction and (2) the method used by the investigator to conduct the research (survey, historical, empirical, etc.). The major educational research publications, such as those cited above, treat both of these methods but devote much more extensive space and treatment to the "method used" type of classification. A third and more recent possibility has been proposed by Guba:

> [the system is] based on the formal properties of the design and of the sample used in the research whose categories range from "investigations" (the class with the least rigorous formal properties) through "surveys" and "studies" and culminating in "experiments" (the class with the most rigorous formal properties).[4]

Guba and Clark describe all three of these systems as "widely used but inadequate classification schemes in educational research," and go on to propose a new system that they currently have under development.[5] This new system does appear to hold promise for future communication of research findings to other researchers; however, it is not at the present time sufficiently expanded to be applied to the research problem that is central to this study. The stage of development of the new system is pointed out by the authors of the system in their statement that development of the system was largely intuitive and that "the question of its utility can only be answered through widespread application and empirical testing."[6] No such substantiation is yet under way.

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[3] The reader is referred to such publications as the following: John W. Best, Research in Education, Englewood Cliffs: Prentice-Hall, Inc., 1963; Robert M. W. Travers, An Introduction to Educational Research, New York: The Macmillan Company, 1958; George J. Mouley, The Science of Educational Research, New York: American Book Company, 1963; J. Francis Rummel, An Introduction to Research Procedures in Education, New York: Harper & Row, 2nd Edition 1964; Tyrus Hillway, Introduction to Research, Boston: Houghton Mifflin Company, 2nd Edition 1964; and David R. Cook, A Guide to Educational Research, Boston: Allyn and Bacon, Inc., 1965.

[4] Egon G. Guba and David L. Clark, "Types of Educational Research," Mimeographed manuscript, pp. 1-2. See also Egon G. Guba, "Experiments, Studies, Surveys, and Investigations," Chapter 14 in Jack A. Culbertson and Stephen P. Hencley, eds., Educational Research: New Perspectives, Danville, Illinois: The Interstate Printers and Publishers, Inc., 1963, pp. 237-249.

For the purposes of the present study the classification scheme based on "methodology" was utilized for identifying research in the field of school plant planning. A checklist type of instrument was developed which utilized the central characteristics of the various methodological types of research. This checklist should not be viewed as a description of educational research in general, since the characteristics were selected and described in order to be functional with respect to research pertaining to school-plant planning.

Several different checklists of characteristics of educational research as deemed applicable to school-plant planning were developed. The early lists varied from a few broad descriptive statements to as many as twenty-six very specific items. The problem of a choice of an appropriate checklist raised two basic considerations: first, the use of a statement that was broad and inclusive would require many simultaneous value judgments by the investigator to produce a defensible objective selection, and, second, a large number of very specific statements would make the instrument too unwieldly to deal with the large volume of material which was to be evaluated. The initial instrument tested was a condensation of the original twenty-six specific characteristics to only ten and seemed to represent an optimum compromise between the above basic considerations.

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[5] _Ibid_.

[6] _Ibid_., p. 21.

The initial instrument consisted of a mimeographed checklist containing ten statements of characteristics of research and a YES-NO value judgment asking whether or not each of ten different published articles was considered by the respondent to be a research report. The ten articles were Xeroxed from the originals and were selected to include some articles that were likely to be classified as research, some that obviously lacked research characteristics, and some which were borderline and were likely to present the evaluator with a difficult choice. Although the articles were selected in an attempt to present a range of characteristics, no attempt was made to pre-judge anticipated responses. A random selection was not utilized due to the very small fraction of the total number of articles which could be expected to be evaluated as reports of research.

The ten characteristics were presented as follows, along with ten columns of blanks (one column for each article) to be marked with an X when the characteristic was judged to be present in the article:[7]

1. The problem is clearly defined (in terms of hypothesis(es) or general statement).
2. The related literature is reviewed and documented with at least six references.
3. The population studied is explicitly defined.
4. The study is based on expert opinion.
5. The study is based on survey data.
6. The study is based on case study (-ies).
7. The study is based on experimental investigation.
8. The study utilizes theoretical constructs (concepts).
9. The results of the study are generalizable.
10. The study can be replicated by another investigator.

The YES-NO evaluation was stated as follows:

> Ignoring for a moment the above list of characteristics, does the article or publication in your judgment qualify to be classified as research?

A YES-NO marking arrangement was provided for each column. A cover letter was attached to explain the procedure to be followed.

Twenty-five persons plus the investigator participated in the pilot project in an attempt to assess the usefulness of the instrument for the selection of research reports. Twenty of the subjects were advanced graduate students in educational administration at The University of Wisconsin. Five of the subjects were professors of educational administration. The investigator also evaluated each of the articles in the same manner as did the other twenty-five subjects and included his responses in the tabulations. Another color was utilized in tabulating his responses so that he could later determine the relationship of his evaluations to those of the group.

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[7] See Appendix C.

The responses of the pilot project were charted both by number and by percentage.[8] Areas of high agreement and areas of low agreement were identified. The definition of a high level of agreement was set when eighty per cent or more of the pilot respondents indicated that a statement of a characteristic either (1) was, or (2) was not applicable to an article. The definition of a low level of agreement was set when more than twenty but less than eighty per cent of the respondents indicated that a characteristic was applicable to an article. There were one hundred spaces to be marked, or left blank, on the instrument. Utilizing the above criteria, high agreement was indicated in sixty per cent of the spaces and low agreement in forty per cent of the spaces. More than half of the low agreement spaces were located in the columns for only three of the articles.

The YES-NO section of the instrument indicated high agreement among evaluators on seven of the articles, or seventy per cent, and low agreement on three articles, or thirty per cent. The criteria level used was the same as that set for the statements of characteristics above--eighty per cent of the evaluators concurring that the article (1) was, or (2) was not research. The low agreement in the three articles was not surprising when considered in light of the fact that predicted borderline articles were intentionally included. The three articles which indicated low agreement were articles five, seven, and ten. None of the three low agreement articles was questionably close to the eighty per cent cut-off point--two were divided fifty-eight per cent to forty-two per cent and the third was divided fifty-four per cent to forty-six per cent. Equally as significant was the division on the statements of characteristics for these three articles. There was low agreement on seven of the ten statements for articles five and ten, and low agreement on eight of the ten statements for article seven. This represented twenty-two low agreement items out of the total of forty low agreement items for the entire instrument. Conversely, for the seven articles on which the value judgment showed high agreement, there was also high agreement in a majority of the statements of characteristics, ranging from six to nine high agreement characteristics. It is significant to note that more than half of the items of disagreement were concentrated in the three articles in which the subjects greatly disagreed in their value judgment as to whether or not the articles were research; none of the other seven articles showed a majority of low agreement items. This would indicate that the instrument did discriminate research in most articles where research existed but that there were several articles of a difficult nature which were not satisfactorily treated by the instrument.

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[8] See Appendices D, E, F, and G.

In the value judgment portion of the instrument, the judgment of the investigator was the same as the majority of the subjects on nine out of the ten articles in assessing whether or not the articles qualified for classification as research. In the one article in which the investigator cast his judgment with the minority, the tabulation was a closely divided twelve to fourteen split.

The analysis of the tabulation of the pilot project resulted in the decision to review the problem portion of the instrument with a representation of the twenty-five subjects to determine the ambiguity of articles five, seven, and ten. As a part of this review, the investigator elected to enlist a portion of the pilot project's subjects to evaluate the three articles of low agreement and to refine the statements of characteristics to make them more discriminatory in selecting research in borderline cases. An evaluation sheet was prepared and ten of the original subjects were selected and asked to participate. Eight of the subjects were from the advanced graduate student group and two of the subjects were from the professor group. The subjects were given the evaluation sheet and the original Xerox copies of articles five, seven, and ten. The subjects were not informed of the low agreement of these three articles but were told that the purpose was refinement of the statements.

The evaluation sheet[9] contained three parts, labeled A, B, and C. Part A asked the subject to indicate by circling YES or NO for each article whether, with reference to the articles originally rated, he experienced more than average difficulty in judging if the article qualified for classification as research. The purpose of this question was to determine whether the relatively even original division was a difference in evaluation or the result of inability to reach a conclusion due to confusion. Part B asked the subject to indicate by circling YES or NO for each article if, with reference to the articles originally rated, he experienced more than average difficulty in assessing the characteristics for the article. The purpose of this question was to determine whether there was indeed a confusion on the application of the statement to the three articles of low agreement. Part C asked the subject to make eight of the ten statements more clearly discriminatory by changing words or phrases, or by rewriting the statement, or by giving written comments. Two statements of characteristics were not included because they did not show up as areas of low agreement in the three borderline articles under consideration. The original statement, double-spaced, was presented on the left side of the evaluation sheet and a long blank was provided on the right side of the sheet.

The results of part A indicated that there was probably not significant confusion in making a judgment as to whether or not an article was research but that the subjects were disagreeing with one another on borderline cases. Two of the ten subjects marked YES to article five, two to article seven, and two to article ten. Eight subjects indicated NO to article five and seven subjects indicated NO to articles seven and ten with each also getting one no response. Part B showed more confusion than did Part A. Half of the respondents indicated more than average difficulty in assessing the characteristics for article seven; four reported more than average difficulty for article ten; and three marked Yes for article five. The balance of the subjects reported NO for each of the three articles for Part B with no subject failing to respond. The results for these three articles followed the original instrument closely in that the respondents were quite evenly divided but with article five moving closer to borderline classification.

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[9] See Appendix H.

The comments in Part C were varied. In addition to the written comments, the investigator talked with some of the subjects after the subjects had returned the evaluation sheet. Some of the subjects felt that the problem resided in the articles rather than in the statements of characteristics on the instrument and that the format of the articles was such that statements of characteristics could not really be designed to solve the problem more adequately. This point of view was taken under advisement by the investigator as well as his own observation that there was a wide range of purism, from strict to liberal, toward educational research among the subjects which would easily constitute an interesting study in itself.

As a result of the evaluation and contribution of the subjects, the instrument for selecting reports of research was carefully modified. Cautious attention was given to the incorporation of significant suggestions for making the statements more clearly discriminating. Care was taken not to alter the original research characteristic which each statement was designed to disclose.

The final instrument[10] used to select the items of research contained the following statements:

1. The problem is clearly stated as a hypothesis(es) to be tested or as a question(s) to be researched.
2. The related literature is reviewed and documented with at least six references.
3. The population (or a population sample) investigated is explicitly defined.
4. The report includes the collection and analysis (or synthesis) of expert opinion.
5. The report utilizes the collection and analysis (or synthesis) of survey data.
6. The report includes the collection and analysis (or synthesis) of data pertaining to a case study (-ies).
7. The report utilizes an experimental design and control.

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[10] See Appendix I.

8. The report utilizes theoretical constructs (concepts).
9. The investigator explicitly indicates how and to what related problems the results may (or may not) be generalized.
10. From the information reported, the procedure of the investigation may be replicated by another researcher.

From the pattern of responses in the original pilot study, it was determined that a minimum of three statements should be checked before an article would be accepted as research in school-plant planning for the purposes of this study.

The instrument was applied to the references by the present investigator and the resulting list of research articles was incorporated in the evaluation sections of this study.

Checklist for evaluating research articles. It was necessary to develop a device to standardize the gathering of certain basic information needed for evaluating the research articles.[11] The four areas in which information was desired, if available, were: (1) the problem studied, (2) the design utilized, (3) the findings and conclusions, and (4) the sources of support. A checklist was developed to briefly and quickly record the needed information in these categories. As far as possible, a standardized list of items that could be checked was utilized. In several instances this was not possible and space for a brief annotated statement was provided.

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[11] See Appendix A.

The following information on research articles was recorded when available: (1) the motivating factor and the focus; (2) the method of research, the population, the techniques for collecting data, and the statistical method; (3) the nature of the findings, the agreement or disagreement between educators and architects, the generalizability of the results, and the implications of the study; and (4) the background of the researcher (s), the location where the research was carried on, and the source of support. The checklists were tabulated and the information evaluated with strengths and weaknesses regarding availability of desired information noted.

CHAPTER IV

REVIEW OF THE PERIODICAL LITERATURE--EDUCATION

A total of 2,188 items of periodical literature were reviewed in the course of this study. The total includes all of the items in American periodicals listed under all relevant topics in both major bibliographic indices and the American Doctoral Dissertations sections of the Dissertation Abstracts, which was considered a periodical source for the purpose of this study.

From the references in the Education Index, thirty-three articles were selected as meeting the criteria established. It will be recalled that these criteria were:

1. The reference must bear a relationship to the quality of the environment which is provided for the learning process.
2. The reference must be acceptable as research according to the instrument designed for that purpose.
3. The research in the original form, or a summary in adequate detail, must be published in such a manner as to be available to the practitioner and to the researcher.

Three of the thirty-three references were listed in both the Education Index and the Art Index. Since all three of these references were from an architectural periodical, they are treated with the architectural periodicals in Chapter Five.

A total of one hundred fifty-four doctoral dissertations on school plant were located in the American Doctoral Dissertations. Of this number, forty dissertations could not be treated because they were not located in the Dissertation Abstracts. These forty dissertations were, however, included in the comprehensive guide to school plant periodical literature located in an appendix to this report. Of the remaining total, forty-six dissertations met criteria one above (must bear a relationship to the quality of the environment which is provided for the learning process). These forty-six titles and the thirty titles from the Education Index are reviewed in this chapter.

In the initial screening process, a combined total of nine hundred and sixty-three of the references in both education and architecture were categorized as examples of completed school plants, or "how we [they] did it." This total would have been greater except for the fact that several periodicals grouped their examples of school construction in particular issues during the year and titled the section as well as the article; whenever possible, references of this nature were included as one citation by section title in the extensive classification to school plant references located in an appendix to this report. For the most part, these articles followed a stereotyped pattern of pictures, diagrams, and construction cost and size data, generally mentioning the superintendent and the architect. Not infrequently one or both of these persons authored the article. These articles were considered to be of value basically to those persons looking for ideas or solutions to specific problems. All of the references of this type, including collections of architects' work and design contests of various sorts, were included in one section of the classified reference section of an appendix under the title "Portfolio of Schools".

Major Sources Indexed

There were five educational periodicals that were prominant during the period 1955 to 1964. Not all five of the periodicals spanned the entire ten-year period. These five periodicals were The American School Board Journal, The Nation's Schools, American School and University, School Executive, and Overview. In addition, there were fifty-six other periodicals represented. This number did not include those periodicals eliminated because they had less than three references for the entire ten-year period. Many of the peripheral periodicals contained only a very few school plant planning articles.

Nature of the Literature

Many of the periodical references presented a problem in classification inasmuch as they were generally not written as research and frequently contained a variety of characteristics of a vague and ambiguous nature. When authored by an architect, engineer or related technician, articles frequently contained charts, tables, diagrams or other instruments which, to the uninitiated eye, give the appearance of original research but which, in fact, are commonplace tools of the trade. It was frequently necessary to inspect the article in great detail in order to apply the instrument for discriminating research.

As might be expected, the references exhibited a very wide range of writing skills and organizational abilities as well as degrees of sophistication of material and subject matter reported. Included were many learned and esoteric articles of an essay nature that in some cases appeared to contribute more than some of the articles of research. Indeed, in many instances, these articles represented the refined and evaluative thinking of many years of experience, study, and discussion on the part of well-known authorities. Unfortunately, unless some qualitative measure is developed to identify this type of article--a task more difficult than defining research--these articles will have to be ranked as being as valuable as research by subjective judgment or not at all.

The dissertation research exhibited a generally uniform characteristic, probably due to the requirement of a six-hundred-word abstract for the Dissertation Abstracts. A few abstracts did not appear to summarize the research from the formulation of the problem through the results of the investigation. These few exceptions were principally in the field study category and were usually of a specialized nature. The research articles in the periodical literature, on the other hand, exhibited no recognizable pattern or arrangement and included research reports and reports of research--that is, some articles were the original and complete research report but, more frequently, articles were summaries or abridged reports of results published in the original elsewhere or not at all. As such, the reports varied in length and quality from the bare minimum to a full-blown report. Since the major instrument developed for this study discriminated research but did not evaluate the fullness of the content beyond the minimum, the method of determining whether sufficient information was present to merit inclusion in this study was by means of the reference data form used to standardize the information collected; if sufficient information was present to satisfy the most basic parts of the form, the article was included in the study. A few reports were very brief summaries.

Review of the Literature Located

The following is a brief summary of the research located.

Planning Procedure. Seven of the dissertations and four of the articles fell in this category.

Whigham[1], in a dissertation at New York University in 1956, attempted to develop a theory for school plant planning. He analyzed the resources in the related literature, conducted interviews and observations in fifteen school systems, and used a jury technique for authoritative judgments. He concluded that complex factors were involved, that the factors were interrelated, that complex human relations were involved, that the factors were dynamic and changing, and that the situation was unique for each planning experience.

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[1] Edward L. Whigham, "Educational Planning for School Plant Construction," (unpublished Doctor's thesis, University of New York, 1956). Dissertation Abstracts, 16: 1392, 1956.

Two periodical articles, one in the School Executive and one in the American School Board Journal, reported on general educational planning. The article in the School Executive, by the School Executive Research Department,[2] entitled "Educational Planning of the School Plant: Symposium," reported a questionnaire survey of one thousand school superintendents throughout the United States and a six-district case study. The superintendents agreed that there were many different people and groups involved, that varying amounts of time were involved, and that more time should be spent on educational planning. The study implied that the importance of school planning was recognized even when planning was not adequately practiced. The article in the American School Board Journal, by Robert E. Hummel,[3] entitled "Who Does the Educational Planning for Your School?," dealt with what educational planning should be. This article was one of only two located in the periodical literature which indicated in some manner that it was based on a doctoral dissertation.[4] The research was a survey of more than one hundred California school districts ranging from 5,000 to 40,000 in average daily attendance. Superintendents and school planning directors were surveyed to identify current practice and to secure improvement ideas. In addition, nearly thirty practicing architects oriented toward school design were questioned. Hummel's study disclosed the following information: 1) well-written specifications were essential; 2) a minimum of six months planning for elementary schools and one year for secondary schools was desirable; 3) release time for staff involvement was worthwhile; 4) outside planning direction was necessary if the staff was unable or unwilling to participate; 5) a recently completed facility evaluation was a necessary preliminary procedure; 6) the areas of responsibility should be clearly defined; 7) educational planning groups were a valuable part of the planning; and 8) the employment of an able architect was a vital part of the program.

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[2] School Executive Research Department, "Educational Planning of the School Plant; Symposium," School Executive, 75: 73-87 (February, 1956).

[3] Robert E. Hummel, "Who Does the Educational Planning for your School?," American School Board Journal, 144:32-35 (March, 1962).

Two dissertations dealt with specific involvement of staff groups. A dissertation by Ralph E. Lee,[5] titled "An Appraisal of Teacher Participation in Secondary School Planning," is a case study of three school districts in California.

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[4] Robert E. Hummel, "Educational Planning Procedures for School Building Construction," (Unpublished Doctor's thesis, University of Southern California, 1961). Dissertation Abstracts, 21:3686, 1961.

[5] Rolf E. Lee, "An Appraisal of Teacher Participation in Secondary School Planning," (unpublished Doctor's thesis, Stanford University, 1957). Dissertation Abstracts, 17: 2482-2483, 1957.

Lee found little productive results in the three districts he worked with. He did find that the administration considered the construction a result of teacher planning but that the teachers doubted that their thinking was included in the structure. Further research was indicated as necessary to illuminate optimum methods for teacher participation. A recent dissertation at Columbia University by Alden A. Larson[6] dealt with the planning role of the high school principal. The dissertation developed guidelines for the role of the building principal in school plant planning. It focused on the Greenburgh school project and was a single case study. As a result of the analysis of this case study, Larson made general recommendations of good procedures and guidelines for school plant planning.

In a dissertation of a regional nature, at Temple University in 1964, Henry R. Hoerner[7] surveyed educational planning in Delaware. He focused his attention on investigating the role that educational planning played in determining school plant design for elementary and secondary schools in that state. Utilizing questionnaires and interviews, Hoerner compared opinions of authorities in the literature with questionnaire responses and best planning practices as revealed in the interviews. He found that there were written educational plans by only forty-four per cent of the districts in the study and listed nine other lesser characteristics. Hoerner also indicated that educational plans should be written and that broad involvement of people in the planning process is a necessity.

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[6] Alden A. Larson, "The Development of Guidelines As To the Role of the High School Principal In Planning A Secondary School Building," (unpublished Doctor's thesis, Columbia University, 1964). Dissertation Abstracts, 25: 5062-5063, 1965.

[7] Henry R. Hoerner, "A Comparative Investigation of the Role Educational Planning Plays in Determining School Plant Design for Elementary and Secondary Schools In the State of Delaware," (unpublished Doctor's thesis, Temple University, 1964). Dissertation Abstracts, 25: 4497-4498, 1965.

In another regional study of school plant planning, Thomas Terjeson,[8] in a doctoral dissertation at the University of Washington in 1963, surveyed existing practices in school plant planning to determine the manner in which selected school districts had developed the administration of the school plant and the actual procedures of the planning program. Terjeson used the questionnaire technique with superintendents of first-class school districts in Washington and selected districts in other states. He found that there were no uniform practices for planning, that responsibility was centered in one person authorized by the board, that committees which included citizens and staff members assisted the superintendent and were appointed by him. The queried group considered five to nine years as long-range. Most districts prepared educational specifications; and citizens participated. Oral reporting was found to be the most common and studies were found to be community-wide in nature.

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[8] Thomas Terjeson, "An Analysis of School Plant Planning in Selected Districts in Washington and Certain Other States," (unpublished Doctor's thesis, University of Washington, 1963). Dissertation Abstracts, 24: 4518-4519, 1964.

In a doctoral dissertation in 1963, Thomas N. Keating,[9] at the University of Nebraska Teachers College, sought to determine the effectiveness of various procedures which had been used in school building programs by Nebraska schools. In a survey of ten Nebraska schools selected on rather detailed criteria, and using an open-ended, tape-recorded interview on questions pertaining to the study, he developed a list of nine procedures classified as effective in Nebraska. Keating recommended his study to ~~superintendents~~ facing.bond issues and students of educational administration.

The results of school plant planning were surveyed by Stanley C. Campbell[10] at the University of Wisconsin. Utilizing the questionnaire technique in his study of six schools, he found a negative relationship between comprehensiveness of planning and juror evaluations of the resultant plant quality. Because his sample was so small, Campbell cautioned against generalizing his results. He also found that each plant planning experience was unique.

The failure to provide sufficient prior planning was surveyed by Matt O. Hanhila[11] in a study to determine whether or not double sessions affected educational opportunities of high school students. Utilizing delinquency records and an annoyance scale instrument, he found that there was no statistical significance in the grade points, no significance on a comparison of gains in the Iowa test of educational development, and no significance in juvenile reports between morning and afternoon sessions. He did find that differences between double and regular sessions on the annoyance scale were significant at the .05 level.

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[9] Thomas N. Keating, "The Effectiveness of Procedures Used in School Building Programs in Nebraska," (unpublished Doctor's thesis, University of Nebraska Teachers College, 1963). Dissertation Abstracts, 24: 5132-5133, 1964.

[10] Stanley C. Campbell, "Relationships Between the Comprehensiveness of School Plant Planning Procedures and the Quality of Resultant School Plants," (unpublished Doctor's thesis, University of Wisconsin, 1961). Dissertation Abstracts, 22: 1880-1881, 1961.

Educational Specifications. One study dealt with the topic of educational specifications. In this study at the University of Tennessee, Ova P. Roaden[12] attempted to identify the essential elements of educational specifications. The dissertation utilized the survey and jury system methods. The literature was examined and twenty-five sets of educational specifications were analyzed, resulting in a list of twenty-four tentative essential items. This list of items was submitted to a jury and seventeen elements evolved as being essential to educational specifications. Roaden found that educational specifications, while vital, were not yet in widespread use although their use was increasing. Their main purpose was for use by the architect. Of the seventeen essential elements identified, ten were general elements and seven were specific elements. Roaden also included a list of additional items that might be considered.

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[11] Matt O. Hanhila, "Are Double Sessions Students Penalized Academically?," American School Board Journal, 143: 13 (December, 1961).

[12] Ova P. Roaden, "The Essential Elements of Educational Specifications for School Plant Facilities," (unpublished Doctor's thesis, University of Tennessee, 1963). Dissertation Abstracts, 24: 593, 1963.

Pupil Capacity and Desirable Size. Three investigations, all doctoral dissertations, dealt with the pupil capacity of schools.

In a doctoral dissertation at Ohio State University in 1952, Marion J. Conrad[13] developed a formula for determining the operating capacity of secondary school buildings. The formula was developed by means of analyzing and synthesizing the essential factors. In addition to developing the formula, Conrad concluded that true operating capacity involved more than size and numbers and that it was impractical to use every room every hour of every day of every week. Conrad indicated that with slight modification, the formula would determine housing requirements in planning new school buildings. He also indicated that the subject would have to have more research on such input factors as desirable class size and grouping. In a study on space allocations, pupil capacity, and unit cost of twenty Indiana secondary schools, William S. Fuller[14] found that there was an interrelationship between enrollment, instructional space, number of grades, and accreditation. Fuller utilized the original drawings for most of his data in the twenty Indiana schools and obtained cost data from school officials. In another regional study, Henry J. Gatski[15] attempted to analyze the effectiveness of four formulae designed to indicate the rate of pupil capacity of secondary schools. Gatski utilized fifty selected junior, senior, and junior-senior high school buildings in Pennsylvania and applied the Pennsylvania State Department of Public Instruction capacity formula and three other formulae. In addition he surveyed administrative opinion. He calculated the percentage of difference between enrollment and the various capacity ratings. Gatski found that twenty of the fifty schools had enrollments that exceeded rated capacities and twenty-three schools had enrollments that were near or exceeded rated capacities. He recommended that the state of Pennsylvania review the present rating formula and use his system to keep the state formula current.

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[13] Marion J. Conrad, "A Technique for Determining the Operating Capacity of Secondary School Buildings," (unpublished Doctor's thesis, Ohio State University, 1952). Dissertation Abstracts, 17:2891-2893, 1957.

[14] William S. Fuller, "Space Allocation, Pupil Capacity and Unit Costs of Twenty Selected Public Secondary School Buildings Constructed in Indiana During 1948-1958," (unpublished Doctor's thesis, Indiana University, 1960). Dissertation Abstracts, 21: 517, 1960.

Two dissertations, both of a regional nature, dealt with the relationship between size of high school and achievement. In a study at Iowa State College in 1958, Irvin T.

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[15] Henry J. Gatski, "A Comparison of Four Formulae for Rating Pupil Capacity of School Buildings in Selected Secondary Schools in the State of Pennsylvania," (unpublished Doctor's thesis, The Pennsylvania State University, 1963). Dissertation Abstracts, 1045-1046, 1963.

Lathrop[16] utilized a sample of 1,516 students to focus on high school size and course pattern. He found that high school size had little relationship with achievement at Iowa State College but that the high school course pattern did influence achievement. In a similar study at the University of Arkansas, Fay W. Smith[17] studied high school size to achievement of college bound seniors in Arkansas. Smith utilized a random selection from 3,250 Arkansas college bound seniors. Applying the sample to the ACT program, the group was divided according to high school size and five groups were set up. Using a statistical test, Smith found that size was significant. In general, the study indicated that college bound seniors from high school classes of 400-plus achieved at a higher level than small high school graduates. In some subject areas, the six hundred-plus group size achieved higher.

Two dissertations focused on high school size, cost, and other factors. Desmond H. Bragg[18] studied the relationship between the net enrollment, the per pupil cost, and student achievement in the elementary schools in the reorganized districts of Wisconsin. Utilizing all ninth graders who spent their entire school life in the district, he found no correlation between size and achievement and none between cost and achievement. He further found that the only factor consistently agreeing with achievement was the student's intelligence. Ralph D. Jantze,[19] in a study comparing high school size, accreditation, and finance to scholastic achievement in Nebraska, sampled forty-six Nebraska secondary schools that were categorized into accreditation rankings by the Nebraska State Department of Education, into cost groups on per pupil cost, and into size groups. Jantze found achievement was greater in the two higher levels of accreditation, but achievement was greatest when per pupil expenditure was greatest, with some exceptions. He also found that achievement increases with enrollment to between 400 and 799 students, and then it decreases.

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[16] Irvin T. Lathrop, "Scholastic Achievement at Iowa State College Associated with High School Size and Course Pattern," (unpublished Doctor's thesis, Iowa State College, 1958). Dissertation Abstracts, 19: 78-79, 1959.

[17] Fay W. Smith, "An Analysis of the Relationship of Size of Arkansas High Schools and the Achievement of College Bound Seniors," (unpublished Doctor's thesis, University of Arkansas, 1961). Dissertation Abstracts, 21: 3332-3333, 1961.

[18] Desmond H. Bragg, "A Study of Size-Cost-Achievement Relationships in Reorganized School Districts of Wisconsin," (unpublished Doctor's thesis, University of Wisconsin, 1960). Dissertation Abstracts, 21: 1432-1433, 1960.

Three dissertations focused on elementary school size. Utilizing 90 elementary schools of grades one through six in six Florida counties, Louis E. Teets[20] related size, per pupil cost, and the extent of educational opportunity. He found a peak size at 300 to 399 students, a greater peak at 600 to 699 students, a plateau at 700-plus students and an optimum size of 600 to 699 students. Teets found that the lowest cost was in the 600 to 699 group and that the opportunity-cost ratio was at 600 to 720 students. David D. Basler[21] studied some of the factors involved in the determination of the optimum size for elementary units at the University of Iowa in 1960. Utilizing single, double, and triple size elementary school units, he found the weight of evidence favored the double unit. A third study on the size of elementary school relationships was conducted by Urban J. D. Leavitt.[22] Leavitt explored the relationship of elementary school size intervals to the provision and utilization of facilities, space, and personnel. Utilizing a jury of 438 professional educators and a sample of seventeen selected elementary schools of different sizes, Leavitt concluded that the optimum size interval "may" lie within a range of 200 to 699 pupils and that the best personnel usage was in the 200 to 399 pupil range.

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[19] Ralph D. Jantze, "An Analysis of the Relationship of Accreditation, Finance, and Size of Nebraska High Schools to Scholastic Achievement," (unpublished Doctor's thesis, The University of Nebraska Teachers College, 1961). Dissertation Abstracts, 22:1068-1070, 1961.

[20] Louis E. Teets, "Relationship in the Elementary School Between Size, Per Pupil Cost, and the Extent of Educational Opportunity," (unpublished Doctor's thesis, University of Florida, Gainesville, 1956). Dissertation Abstracts, 16: 2375-2376, 1956.

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[21] David D. Basler, "An Investigation of Certain Factors Influencing the Optimum Size for Elementary School Attendance Units," (unpublished Doctor's thesis, State University of Iowa, 1960). Dissertation Abstracts, 21: 1812-1813, 1961.

[22] Urban J. D. Leavitt, "Elementary School Size Relationships," (unpublished Doctor's thesis, The University of Texas, 1960). Dissertation Abstracts, 20: 4572; 1960.

In a study of a more regional nature, Jack W. Crocker[23] studied the size and organization of white junior high schools in Alabama. Crocker's findings were, in general, that as size of enrollment rose, level of teacher preparation rose, and that variety increased with size, including a finding of a wider variety in three-year schools than in the two-year types.

Four studies were located that focused on the optimum size of secondary schools, some of which included factors in addition to size. In an article entitled "Is There An Optimum Size High School?," A. H. Livingston,[24] in a documentary study, concluded that the particular needs of the community must be the criteria on which the decision of high school size is made. All other things being equal, and if the decision is made on size alone, 2,000 seems the most desirable size to select. A smaller size school was the recommendation of the doctoral study of Clifford B. Smith,[25] who surveyed 352 secondary schools by questionnaire. In addition to the questionnaire, Smith utilized the Annual Principal's Report of the State Department of Education. In a statistical analysis, Smith concluded that 800 to 1200 pupils is the size range at which favorable factors approach the maximum and unfavorable factors approach the minimum. Still another finding resulted from a doctoral study by Stuart C. Gray,[26] who examined twenty seniors from each of forty Iowa secondary schools. Gray's statistics indicated that there was a very small difference of achievement favoring larger schools, but that the difference was not significant; other factors such as faculty turnover, multi-use, special services, and extracurricular activities were statistically significant in favor of the larger school. Gray found that a plateau was reached on most factors at around 400 students. In an article in the American School Board Journal, S. S. Mayo[27] agreed with the findings of A. H. Livingston when he concluded that a high school of 2,000 appears to be the maximum desirable size. Mayo based his study on extensive recorded experience in California high schools.

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[23] Jack W. Crocker, "The Relationship of Size and Organizational Type to Certain Factors in Alabama's White Junior High Schools," (unpublished Doctor's thesis, University of Alabama, 1960). Dissertation Abstracts, 21: 2529-2530, 1961.

[24] A. H. Livingston, "Is There an Optimum Size High School?," Progressive Education, 33: 156-159 (September, 1956).

[25] Clifford B. Smith, "A Study of Optimum Size of Secondary Schools," (unpublished Doctor's thesis, Ohio State University, 1960). Dissertation Abstracts, 21: 2181-2182, 1961.

General Planning and Design Factors. One of the early significant planning ventures in design for design's sake was the Random Falls idea by Archibald B. Shaw and John Lyon Reid.[28] As a primary example of the "search" in research, Shaw and

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[26] Stuart C. Gray, "A Study of the Relationship Between Size and a Number of Qualitative and Quantitative Factors of Education in Four Sizes of Secondary Schools in Iowa," (unpublished Doctor's thesis, State University of Iowa, 1961). Dissertation Abstracts, 22: 2631, 1962.

[27] S. S. Mayo, "What Size High School?," American School Board Journal, 144: 32-33 (January, 1962).

[28] Archibald B. Shaw and John L. Reid, "Random Falls Idea; An Educational Program and Plant for Youth and Community Growth," School Executive, 75: 47-86 (March, 1956).

Reid proposed an extensive redesigning of the program of secondary education. Utilizing a hypothetical situation that was not tied to present standards in any way, they formulated specifications and proposed a building design for an entirely new type of program. The program included nothing in the way of unusual materials or ideas presented but was put together in its entirety; this had not been done in an actual building program. Six years later, Shaw and Linn Smith[29] undertook a similar project entitled "New High School." In this study, an attempt was made at design unhibited by usual demands on the architect, board of education, and administrator. The result of this study was a hypothetical school of today which sought solutions to current problems. More recently, in March of 1964, the staff of American School and University, in a study similar to the ideas of the previous hypothetical studies, put forth a proposal titled "All-Age School."[30] The school was the result of what was described as a summary of research statistics and the commentaries, reports, symposia, pleas, calls and intuitions of educators. The hypothetical all-age school was designed to bridge the gap between the very young and the over-age-fifty-five group. If reported in a manner that would meet the limited criteria of this study, such valuable contributions as C. W. Brubaker's "Q space" concept and some of the hypothetical research by

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[29] Linn Smith and Archibald B. Shaw, "New High School," Educational Executives' Overview, 3: 33-48 (March, 1962).

[30] American School and University, "All-Age School," American School and University, 36: 27-31 (March, 1964).

W. W. Caudill could be reviewed here.

In a statistical study utilizing three matched pairs of students in grades two, four and six, Barney Kyzar[31] studied the relationship between school plant design and the instructional program. He deals specifically with an "open plan," which consisted of classrooms with three walls and separation from the corridor by means of movable partitions or storage space. Collecting his data by means of observation, Kyzar found that in five of the seven components of instruction (curriculum organization, social organization, psychological climate, order-maintaining techniques, and provision for individual differences) statistically significant differences were found favoring schools designed on the "open plan." In interpreting his findings, Kyzar indicated that the "open plan" classrooms were not sufficiently different from conventional classrooms to cause significant differences directly attributable to design. Dr. Kyzar's article was quite similar to the study he undertook for his doctoral dissertation at the University of Texas.[32] In his dissertation, he analyzed by observation with an instrument designed to investigate noise, nine schools. Three of the schools were designed with three-wall classrooms, three with three-open or incomplete, and three with conventional classrooms. Kyzar found that the open plan was favored but he questioned whether the design of the building was totally responsible. He further found that the design did not appear to affect activities or the utilization of activities or of floor and display areas, that noise was not a problem, and that little use was made of corridor space other than for passage.

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[31] Barney Kyzar, "School Plant Design and the Instructional Program," American School Board Journal, 145: 25-26 (August, 1962).

[32] Barney Kyzar, "A Comparison of Instructional Practices in Classrooms of Different Design," (unpublished Doctor's thesis, The University of Texas, 1961). Dissertation Abstracts, 22: 3490-3491, 1962.

Carl T. Bergstrom,[33] in a dissertation at Michigan State University, studied changing programs and their effect on school plant. Utilizing Detroit schools from which grades one, two and three had been removed by a program change, he found that degree of modification necessary does decrease educational adequacy of buildings.

Two dissertations and an article dealing with desirable features of buildings were located. Paul Phillips,[34] in a dissertation at Temple University in 1956, attempted a survey of current elementary school construction features utilizing a questionnaire and field trip observation with thirty-nine select elementary schools in various sections of the nation. Phillips also sent 325 questionnaires to administrators of new construction. He produced a long list of recommendations and concluded that there were quite a few successful ideas and features that ought to be used by more schools. Louis A. Bohn[35] focused his attention on the desirable and undesirable features and space in elementary schools. Surveying twenty-six buildings with check lists, questionnaires and personal interviews, Bohn found most of the newer innovations to be desirable. He also found a long list of common undesirable features. More recently, in October of 1964, the *Nation's Schools*[36] polled schoolmen concerning those facilities and new construction that schoolmen wanted most and those that they would reject for elementary schools and secondary schools. Of the four per cent of the 16,000 schoolmen in the continental United States that were sent questionnaires, thirty-one per cent responded to the questions. By simple tabulation, lists of desirable and undesirable features were presented. In the elementary school, most desirable features included operable walls for team teaching and least desirable features were windowless classrooms. In the secondary schools, most desirable features were also operable walls for team teaching and the least desirable features were smoking facilities for students.

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[33] Carl T. Bergstrom, "An Analysis of the Impact of Program Change on School Plants," (unpublished Doctor's thesis, Michigan State University, 1961). Dissertation Abstracts, 22: 4264, 1962.

[34] Paul Phillips, "A Survey of Construction Features Found in 325 New Elementary School Buildings," (unpublished Doctor's thesis, Temple University, 1956). Dissertation Abstracts, 17: 291-292, 1956.

Three references were located with regard to space allocation and utilization. In an area study in the state of Washington, Ernest Hayes[37] reported the results of a survey of twenty-three new public high schools. He found a greater variation than expected in space allocations to instructional areas, no trends, and many unanswered questions about planning and designing. Also in an area study, in the state of Indiana, George Lucht[38] studied space allocations and unit costs in elementary schools. Lucht determined allotment of floor area percentage of major portions of construction contracts and calculated the cost per station, per square foot, and per classroom. In a dissertation at Penn State University, Donald R. Salisbury[39] considered outstanding school plants in order to determine the space allocation for instructional service and administration in the selected school plant. Utilizing an instrument that was mailed out, he concluded that costs of the selected school buildings were in keeping with the percentage of productive space within the buildings, that administration and service space was not excessive, and that the relationship between teaching, administration, and service space was exemplary.

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[35] Louis A. Bohn, "Desirable and Undesirable Building Features and Spaces in Selected Elementary Schools," (unpublished Doctor's thesis, The University of Texas, 1958). *Dissertation Abstracts*, 19: 997-998, 1958.

[36] Nation's Schools, "What Schoolmen Want in Buildings," *Nation's Schools*, 74: 76-77 (October, 1964).

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[37] Ernest Hayes, "Space Allocation in Washington High Schools," American School Board Journal, 130: 39-40 (June, 1955); 131: 21-22+ (July, 1955); 131: 27-28 (August, 1955).

[38] George Lucht, "A Study of Space Utilization and Unit Costs of 75 Elementary School Buildings Constructed in Indiana During 1948-1954," (unpublished Doctor's thesis, Indiana University, 1954). Dissertation Abstracts, 15: 368-369, 1955.

[39] Donald R. Salisbury, "Space and Cost Allocation for Service, Administrative and Instructional Areas in Selected Elementary and Secondary Schools," (unpublished Doctor's thesis, Pennsylvania State University, 1957). Dissertation Abstracts, 18: 135, 1958.

Pupil control factors to be included in educational specifications for the architect was the topic of a dissertation by Earle E. Wenbourne.[40] In a survey of administrative personnel, teachers and students, Wenbourne found pupil control was improved through planning and subsequent design.

In a specialized study, John J. McNicholas, Jr.[41] investigated thirty-seven new elementary schools in Chicago. Utilizing an instrument design based on the latest criteria located in the literature, he made recommendations for the educational criteria to be used in planning new elementary school buildings in Chicago. McNicholas indicated that Chicago and other urban districts might utilize the data and criteria in their elementary school studies. In a more general study, Frank R. Yulo[42] studied the small school design in detail. With twenty-seven schools serving as a laboratory to point up needs, Yulo listed five areas of major concern based upon organizational patterns and learning materials for the

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[40] Earle E. Wenbourne, "Pupil Control Factors to be Considered in Planning School Plants for the Grossmont (California) Union High School District," (unpublished Doctor's thesis, The University of Nebraska Teachers College, 1962). Dissertation Abstracts, 22: 4249-4250, 1962.

[41] John J. McNicholas, Jr., "The Development of Educational Criteria for New Elementary Schools in Chicago," (unpublished Doctor's thesis, Michigan State University, 1961). Dissertation Abstracts, 22: 1889, 1961.

[42] Frank R. Yulo, "General Factors Related to the Educational Specifications for the Physical Facilities of the Small Twelve-Year School (Grades K-12)," (unpublished Doctor's thesis, Columbia University, 1962). Dissertation Abstracts, 23: 4206-4207, 1963.

Catskill area of New York.

In two studies which indicated promise for school research of the future, K. Gibbons and K. T. Hereford[43] analyzed in 1955 school design trends indicated by 100 schools entered in the School Executive Design Competition. By means of a synthesis of evaluations of the schools and "jury" findings, the editor and architect determined that the objectives of the architects seemed to be economy, functional building, and "liveableness." In a similar study the following year, M. J. Pillard and Gibbons[44] focused on the 147 new educational structures that were entered in the design competition. The findings for that year were that the future of school architecture promised many variations and that budgetary problems were still paramount. After two years, the practice of analyzing the design schools tapered off and the format changed to another approach.

In a staff article by Educational Executives' Overview[45] in March of 1963, the middle school was the subject of a detailed study. Specifications for the middle school were established by means of expert opinion and eighteen characteristics of a new building program were outlined. It was the intent of the research to serve as a guide for the sixth-, seventh-, and eighth grade middle school program.

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[43] K. Gibbons and K. T. Hereford, "Panorama of 100 New Schools," School Executive, 74: 69-101 (April, 1955).

[44] M. J. Pillard and K. Gibbons, "Let's Take a Look at New Schools," School Executive, 75: 61-91 (June, 1956).

[45] Educational Executives' Overview, "Planning and Operating the Middle School," Educational Executives' Overview, 4: 52-55 (March, 1963).

Thermal Environment. Three studies dealing with the effect of the thermal environment on learning were located. In a dissertation entitled "A Study of Factors Involved in Establishing a Satisfactory Thermal Environment in the Classroom," Homer F. Mincy[46] analyzed and appriased conditions in twenty-seven classrooms in nine schools. Utilizing instruments to measure room conditions, Mincy found that classroom conditions varied widely and often were not within accepted levels. Rooms that met standards typically had unit ventilators. Working in conjunction with the Lennox Research School, Charles M. Peccolo[47] completed his doctoral dissertation at the State University of Iowa on the effect of thermal environment on learning. To determine differences in learning due to thermal environment, Peccolo utilized matched pairs of fourth grade children. By means of the detailed instrumentation of the Lennox classrooms, he determined that, with some exceptions, significantly higher gains were achieved by the experimental group in the ideal thermal environment. Peccolo noted that many additional factors needed experimentation in greater depth and detail. In a staff article titled "Two Studies on

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[46] Homer F. Mincy, Jr., "A Study of Factors Involved in Establishing a Satisfactory Thermal Environment in the Classroom," (unpublished Doctor's thesis, The University of Tennessee, 1961). Dissertation Abstracts, 22: 3069, 1962.

[47] Charles M. Peccolo, "The Effect of Thermal Environment on Learning," (unpublished Doctor's thesis, State University of Iowa, 1962). Dissertation Abstracts, 23: 2775, 1963.

Thermal Environment and Learning" in the December 1963 issue of American School Board Journal,[48] a study of the effect of thermal environment on learning was reported. Using forty-four matched pairs of fourth grade pupils in the Lennox research school, the study found that on the whole there was large improvement by every child taking part in the ten types of tests; in every task the experimental group improved more than the control group.

A number of studies in thermal environment with regard to air-conditioning have been conducted by Henry Wright. Two such studies were reported in the American School Board Journal. In an article entitled "What Does School Air-Conditioning Cost?,"[49] Wright described a survey of seventeen schools in twelve states which indicated that the average cost of air-conditioning was approximately 75¢ more per square foot than conventional heating. Wright concluded that common sense indicates that air-conditioning costs are not "outlandish". In a later article titled "A Definitive Experiment With Air-Conditioning,"[50] Wright attempted to determine whether there was significant difference in cost of operation, educational achievement, and incidence of illness or psychological problems with the use of air-conditioning. Utilizing an actual building and basic costs, Wright concluded that there was no difference in costs. The study of the educational achievement and incidence of illness and psychological problems was incomplete at the time of the writing.

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[48] American School Board Journal, "Two Studies on Thermal Environment and Learning," American School Board Journal, 147: 22-24 (December, 1963).

[49] Henry Wright, "What Does School Air Conditioning Cost?," American School Board Journal, 136: 33-34+; (January, 1958).

[50] Henry Wright, "A Definitive Experiment with Air Conditioning," American School Board Journal, 142: 29-32 (January, 1961).

Sonic Environment. Because the use of carpeting is frequently associated with sound control, carpeting has been included under the sonic classification. Although several experiments have been conducted with carpeting, only one report of such research was located. Elizabeth Nabors[51] reported a sufficient portion of the Shaker High School carpet experiment to merit inclusion in this study. By means of a time log technique, the investigators concluded that the cost of carpet averaged two-thirds more than the cost of asphalt tile and that the maintenance cost of carpet was one-half that of asphalt tile. The study implied that the cost image of carpeting was a more serious problem than long-run total costs.

Darwin W. Womack,[52] at the University of Tennessee, conducted a doctoral study on classroom acoustics entitled, "A Study of Factors Involved in Establishing a Satisfactory Acoustical Environment in the Classroom." Womack worked with three classrooms from each of nine schools. His criteria were drawn from the literature and he applied the criteria to the classrooms by methods that included observation and acoustical measurements. His findings led to the conclusion that the acoustical environment in all the classrooms was inadequate for optimum speech communication and that most of the classrooms were too noisy for optimum speech intelligibility.

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[51] Elizabeth Nabors, "School Carpet--Does It Make Sense?," American School Board Journal, 147: 34-36 (October, 1963).

[52] Darwin W. Womack, "A Study of Factors Involved in Establishing a Satisfactory Acoustical Environment in the Classroom," (unpublished Doctor's thesis, The University of Tennessee, 1962). Dissertation Abstracts, 23: 3217-3218, 1963.

Esthetic Environment. Although many other considerations are included in the make-up of the esthetic environment, the most predominant consideration has been that of color. All five of the esthetic studies that were located dealt with color.

Two psychological journals reported color studies. In a study by T. A. Pasto and P. Kivisto,[53] 120 subjects were tested with color charts and with the Roshard Card X. The subjects were asked to select the most and least pleasing or attractive on both the color chart and the card X. The percentage response within each group was calculated and the findings indicated that blue and red were the popular choices of both groups--gray and brown the least. Normal women shifted their preference more than normal men. In a study entitled "Effect of Color Illumination Upon Perceived Temperature," P. C. Berry,[54] writing in the Journal of Applied Psychology, reported a study to determine whether a person's surroundings would affect perceived temperature and if this could be used to improve comfort. Utilizing twenty-five paid volunteer adults, high school graduates, in a controlled situation involving an auto trainer as a guise, Berry found that subjects did not show any change in the levels of heat they would tolerate as a function of the colors of illumination, and that the subjects nevertheless persisted in the conventional belief that green and blue were "cool" colors when asked to rank the colors they had experienced.

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[53] T. A. Pasto and P. Kivisto, "Group Differences in Color Choice and Rejection," Journal of Clinical Psychology, 12: 379-381 (October, 1956).

[54] P. C. Berry, "Effect of Color Illumination Upon Perceived Temperature," Journal of Applied Psychology, 45: 248-250 (August, 1961).

Three doctoral dissertations were located which dealt with the color environment. As in the case of the two psychological experiments, these studies also fell in the latter part of the time period of this investigation. In a doctoral dissertation at New York University in 1962, Morris J. Rudner[55] studied color and student achievement by means of classrooms that were painted at mid-year. Rudner utilized six elementary school classrooms and eight secondary school classrooms and had sufficient prior data regarding the use of the rooms. In a statistical analysis, he concluded that in only one of the fourteen tested classrooms was color a significant factor in student achievement, within the hues, values and intensities of colors used in his experiment. He found that paint companies kept no records of paint sales to schools. At the University of Tennessee, also in 1962, in a historical type of research on the effects and importance of color on human beings and appropriate school environment, Bettye U.

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[55] Morris J. Rudner, "A Study of the Effect of Classroom Color on Student Achievement," (unpublished Doctor's thesis, New York University, 1962). Dissertation Abstracts, 23: 1989-1990, 1962.

Johnson[56] compiled a list of eight factors and two implications that influence color choices for the various schoolhouse areas. Johnson indicated that the prime factor in color choice should be the provision of the appropriate learning environment to enhance the mental, physical and emotional well-being of the occupants. Further, the selection of colors should fit the individual school and its unique features.

Visual Environment. In a review of research to determine the results of efforts to produce good classroom lighting, Ben M. Harris,[57] writing in 1955, summarized the literature in problem areas or "misconceptions." He defined two basic problems of that time: (1) failure of the fields of education and illuminating engineering to pool their talents to push existing lighting developments into new functional designs and (2) reverence for combining artificial and daylight and too few educational specifications for lighting needs that discourage departure from traditional methods to test designs possibly more functional.

In 1962, at the University of Tennessee, William T. Acuff[58] attempted to analyze and appraise the visual environment in the classrooms of selected schools. He surveyed thirty classrooms in ten schools. By means of library research plus the visual conditions from thirty surveyed classrooms, Acuff concluded that for many measurements taken (levels of illumination, surface brightness relationships, etc.) a majority of the classrooms did not meet established standards.

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[56] Bettye U. Johnson, "A Study of Color in the Classroom Environment," (unpublished Doctor's thesis, The University of Tennessee, 1962). Dissertation Abstracts, 24: 1903, 1963.

[57] Ben M. Harris, "Are Modern Classrooms Lighted for Better Learning?," American School Board Journal, 131: 49+ 50- (September, 1955).

[58] William T. Acuff, "A Study of the Visual Environment in Selected Classrooms," (unpublished Doctor's thesis, The University of Tennessee, 1962). Dissertation Abstracts, 23: 3191, 1963.

Writing in Research Report 8, William M. Pena,[59] a member of the architectural firm of Caudill, Rowlett, Scott and Associates, described the use of the model testing method to take the guesswork out of lighting techniques. By testing a model with the equipment at the Texas Engineering Experimental Station, it was determined that certain fenestration problems could be solved without the use of skylighting. The experiment indicated that model testing of proposed buildings for natural lighting does work. The results from the model testing were later compared with the actual constructed building.

The Education Index disclosed three school lighting research reports in illuminating engineering. All three were during the early part of the ten-year period under consideration--1956.

R. F. Hammel and L. E. Johnson[60] reported an attempt to examine the roles of daylight and manufactured light. Four classrooms, similar to those used in the Upper Mississippi Valley and similar to each other, were used. Costs were amortized and lighting measured by mechanical means. The results indicated that basic utilitarian light can best be supplied by manufactured light while daylight can function best in providing variation and change in the visual picture. J. R. Williams,[61] of the Arizona Public Service Corporation, reported a study to determine how much daylight illumination was provided with fenestration in a sunny part of the country. Four post-World War II classrooms in separate locales in the Salt River Valley area of Arizona were utilized. Foot-candle levels were measured by student teams with light meters in nine room locations every hour classes were in session on forty-five school days. Readings totalled 15,000. The results were averaged and it was concluded that the use of natural light for illumination purposes in classrooms had not been subjected to the precise control that is typical of artificial illumination. E. M. Linforth,[62] working under the auspices of the Rohm and Haas Company, reported an experiment on the use of louvered wall panels of transparent acrylic plastic sheet applied neither outside nor inside but as the window itself to control sunlight and heat. Using a one-half scale adjustable and rotatable test building with measured constant reflectancies of floor, wall and ceiling, it was determined that forty-five degree louvers were not appropriate for control of daylight in classrooms. It was further determined that twenty degree louver panals would provide excellent visual environment. Extreme variation as the sun moved across the sky was reduced and brightness balance was maintained.

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[59] William M. Pena, "Predetermination of Natural Illumination by the Model Testing Method; Research Report 8," American School and University, 1956: 433-436.

[60] R. F. Hammel and L. E. Johnson, "Manufactured Light vs. Daylight for School rooms," Illuminating Engineering, 51: 493-503 (July, 1956).

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[61] J. R. Williams, "Measurements in Daylighted Classrooms in Arizona," Illuminating Engineering, 51: 633-634 (September, 1956).

[62] E. M. Linforth, "Acrylic Louver Wall Panels for Classroom Daylighting," Illuminating Engineering, 51: 231-238 (March, 1956).

In a research report that appeared between revisions of the Illuminating Engineering Society recommendations on schoolhouse lighting, C. L. Crouch[63] reviewed the research on brightness contrast. After reviewing the literature to establish a basis for recommendations on schoolhouse lighting, Crouch determined that the three aspects of visual environment that had to be illuminated and refined by research were the proper ratios for brightness contrast, the need to shield all light sources, and methods and materials to minimize glare. It is only through reviews of available literature in the manner of C. L. Crouch that the reader of periodical literature is likely to find out about such otherwise well-known reports as these of Dr. H. Richard Blackwell at the University of Michigan.

General Environment. Because of the several environmental factors resulting from the windowless classroom, this topic has been placed under a general environmental classification rather than with the preceding environmental studies. In spite of the fact that much has been written and said about windowless classrooms, only one item of research was located, and that in the Dissertation Abstracts rather than in the general periodical literature. Other known experiments have been conducted.

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[63] C. L. Crouch, "Research Establishes Proper Ratios for Brightness Contrast, Need to Shield All Light Sources, and Methods and Materials to Minimize Glare," Nation's Schools, 66: 79-83 (September, 1960).

James A. Chambers,[64] in a dissertation titled "A Study of Attitudes and Feelings Toward Windowless Classrooms" in 1963 at the University of Tennessee, attempted to analyze reactions of students and teachers towards windowless classrooms. His study utilized elementary students in Artesia, New Mexico, secondary students and teachers in Roswell, New Mexico, and undergraduate and graduate students at the University of Tennessee. By means of reaction sheets, Chambers concluded that windowless classrooms were accepted by 91 per cent of the students and teachers in Roswell and Artesia. The most favorable features indicated in Roswell and Artesia were the lack of outside distraction, optimum temperature, and ease of concentration. Major objections included the inability to see outside and lack of a knowledge of weather conditions. At the University of Tennessee there was little "first reaction" against windowless classrooms or objection to them.

One dissertation was located which dealt with the effect of the school plant on the personality of children. In a different type of study, Seymour Gang[65] studied the effect that moving into a new building from an old obsolete building had on Puerto Rican children in New York. Utilizing a statistical analysis and a control group, Gang found a significant difference in favor of the Puerto Rican pupils in the group which changed schools. At the sixth grade level, a marked upward change occurred in the average I.Q. of Puerto Rican girls.

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[64] James A. Chambers, "A Study of Attitudes and Feelings Toward Windowless Classrooms," (unpublished Doctor's thesis, The University of Tennessee, 1963). Dissertation Abstracts, 24: 4498, 1963.

[65] Seymour Gang, "Influence of School Plant Upon Personality Ratings of Elementary School Children in the New York City Public School System," (unpublished Doctor's thesis, New York University, 1961). Dissertation Abstracts, 23: 493, 1962.

Multipurpose Rooms. Although the multipurpose room has been subjected to much discussion over the past ten-year period, only two research references were located on this topic. Both were in the dissertation classification.

In 1957 at Stanford University, Stanley D. McDougall[66] did a survey on the use and function of multipurpose rooms. Utilizing a questionnaire sent to teachers, principals and community leaders in Santa Clara County, California, McDougall established a calendar of use and analyzed the questionnaires to conclude that multipurpose rooms were being used for the same range of purposes that educators had recommended. Some dissatisfaction was registered in his findings but most indicated the multipurpose room was meeting the needs of the school. In another California study of multipurpose rooms, Francis B. Martin[67] compared a survey of the uses of multipurpose rooms with judgments by a selected jury on the topic. Martin supplied a list of activities and facilities for the users and an augmented list for the jury's approval or disapproval. He found that multipurpose unit to be a desirable and integral part of most schools. He also found that local specifications for the multipurpose room were necessary.

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[66] Stanley D. McDougall, "The Use and Functions of Multipurpose Rooms in Santa Clara County, California," (unpublished Doctor's thesis, Stanford University, 1957). Dissertation Abstracts, 17: 1500-1501, 1957.

[67] Francis B. Martin, "Multi-Purpose Units in the Elementary Schools: Appropriate Activities and Required Facilities," (unpublished Doctor's thesis, University of Southern California, 1960). Dissertation Abstracts, 21: 1440-1441, 1960.

Science Facilities. In a study in the Science Teacher, T. W. Munch[68] sought to determine the effectiveness of science facilities constructed for grades seven through twelve between 1953 and 1958. Utilizing a questionnaire distributed nationally, he received 251 returns of which 234 were usable. By means of simple tabulation, Munch concluded that more teachers who use science facilities need to be included in the planning of these facilities, that the trend to multipurpose science facilities was apparent in 1958, that the number of rooms was adequate for new students taking science, that storage and preparation areas were inadequate, and that specific weaknesses were noted and some unique facilities were indicated.

Social Studies Facilities. In another study of specific facilities, Glenn F. Ovard,[69] in a doctoral dissertation at Stanford University in 1959, focused his attention on educational specifications for secondary social studies facilities. Utilizing the jury technique, visitation and interviews, Ovard established a set of fourteen positive statements called specifications.

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[68] T. W. Munch, "Secondary School Science Facilities: Recent Construction--How Effective?," Science Teacher, 25: 398-400+; (November, 1958).

[69] Glen F. Ovard, "Planning Social Studies Facilities for the Secondary Schools," (unpublished Doctor's thesis, Stanford University, 1959). Dissertation Abstracts, 19: 2833-2834, 1959.

Large and Small Group Instruction. Although facilities for large and small group instruction have been largely of recent origin, a 1963 dissertation dealing with this topic was disclosed. Otto Roemmich,[70] working at the University of Southern California, focused his attention on the evaluation of school plant facilities which had been constructed or which were being planned for large group instruction. Using the survey technique, Roemmich examined and evaluated facilities for large group instruction in high schools and junior colleges in California and attempted to develop therefrom a set of desirable procedures, specifications, and practices to be followed in planning, designing, and utilizing such facilities.

Guidance Facilities. One study, a doctoral dissertation, was located in the area of guidance facilities. Kenneth H. Parker[71] focused his attention on the location of guidance facilities. By means of mailable materials and statistical analysis of the results of the questionnaires, Parker concluded that plans for the location could be categorized as "authoritative" or "permissive." He found that the present locations fell into one of the two categories and that two-thirds of both principals and guidance men were dissatisfied with present physical facilities for guidance. He cautioned that careful, cooperative planning was necessary before locating guidance facilities in new secondary construction.

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[70] Otto Roemmich, "Planning, Design, and Use of Large Group Instruction Units," (unpublished Doctor's thesis, University of Southern California, 1963). Dissertation Abstracts, 24: 3612-3613, 1964.

[71] Kenneth H. Parker, "Relating Guidance Philosophy to Function: A Study of the Location of Guidance Facilities Within the School Plant," (unpublished Doctor's thesis, Michigan State University, 1956). Dissertation Abstracts, 17: 798, 1957.

Central Office Facilities. Two doctoral dissertations dealing with central office facilities were located. The earlier of the two, 1960, by Norman C. Richardson,[72] dealt with educational specifications. Richardson carried out a survey of the related literature and visited twenty-two administrative offices in three states. His study supported the assumptions that a lack of proper educational planning, of involvement of building personnel in the planning process, and of written educational specifications were "prime reasons" for administrative building inadequacies. Specific shortcomings were listed and recommendations were made. In a doctoral dissertation at Ohio State University in 1961, Leonard Chaffee[73] worked out a study on the location of the superintendent's office. By means of survey, 82 school districts and 410 school personnel were queried. Chaffee utilized the questionnaire and the jury system and subjected his findings to a weighted index and appropriate statistical measures. He concluded that the location of the superintendent's office in a building used for instructional purposes had a negative influence on the relationship that existed within the administrative complex of the school district. Chaffee recommended a separate facility for the superintendent and a further study of superintendent-principal relationships.

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[72] Norman C. Richardson, "Planning Central Office Facilities for Local School Districts," (unpublished Doctor's thesis, Stanford University, 1960). Dissertation Abstracts, 21: 2562-2563, 1961.

[73] Leonard Chaffee, "The Influence of the Location of the Superintendent's Office on the Educational Administration Complex," (unpublished Doctor's thesis, Ohio State University, 1961). Dissertation Abstracts, 22: 3482, 1962.

Audio-Visual Considerations. Of the published material on the Rensselaer Polytechnic Institute's audio-visual classroom, one report of research magnitude was located in the educational literature. This report was from the Audiovisual Instruction,[74] prepared by the staff and reported in "New Spaces for Learning." Although the results of the Rensselaer classroom were inconclusive at the writing of the article, sufficient preliminary findings of the Architectural Research Center's experimental classroom were presented in the article.

Deac Martin[75] reported a study accomplished in 1956 by the Indiana Audio-visual Research Center on audio-visual lighting. The study focused on conditions that affect audio-visual teaching and was designed to develop suitable controls for audio-visual lighting. By mechanical means, the lighting in the audiovisual room was controlled and evaluated. It was determined that the most satisfactory minimum lighting balance appeared to be about seven-tenths of a foot-candle, although it was possible to read and take notes down to three-tenths of a foot-candle. The experiment was carried on at the Ben Davis Elementary School in Indianapolis so that actual classroom conditions would be present.

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[74] Audiovisual Instruction, "From Research to Mock-up in Three Years," Audiovisual Instruction, 8: 206-207 (April, 1963).

[75] Deac Martin, "Indiana's Audio-Visual Research Center," American School Board Journal, 133: 45+ (December, 1956).

Demountable Construction. One item on demountable construction was located which bore relationship to this study. The primary relationship between standardized construction and the subject of this study is the increased flexibility which is claimed for some of this type of construction. The research was reported by Sun Chien Hsiao[76] in American School and University in 1957. The focus of the study was a standardized, low cost school construction by application of the Unistrut system to schools. It was designed for both flexibility and economy and was experimental in nature. A Unistrut school construction model was erected and tested, a variety of surfacing materials for the building were tested, and the Hoover school was built as a prototype model.

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[76] Sun Chien Hsiao, "Demountable, Low Cost Elementary School," American School and University, 1957: 157-162.

CHAPTER V

REVIEW OF THE PERIODICAL LITERATURE--ARCHITECTURE

Of the total of 2,188 items of periodical literature that were reviewed in the course of this study, a total of fifteen articles were discriminated as research from among the architectural literature. This number includes three articles that were located in both the Education Index and the Art Index; they are treated in this chapter because they were published in an architectural professional journal.

Exclusive of those articles that were classified as graphic illustrations of completed schools and collections or design competitions of completed schools, 198 articles were located in the architectural periodical literature. This was only about one-fourth of the total of 873 located in the same manner among the educational periodicals.

Major Sources Indexed

The use of the Art Index provided access to the four major professional journals in the field of architecture--Architectural Record, Architectural Forum, The Journal of the American Institute of Architects, and Progressive Architecture. In contrast to the minor sources among the educational periodicals, of which there were over fifty found through the Education Index, the elimination of all architectural sources that published less than three school plant articles for the ten-year period under consideration reduced the number of minor sources in architecture to two--Arts and Architecture and Architect and Engineer. Observation of footnote references in the articles scanned indicated to the investigator for this study that some minor references of a specialized nature, especially in the technical and product-promotion aspects of engineering, may not have been located through the use of the Art Index. No practical means of rectifying this problem was found.[1]

In general, the minor sources that were referenced and checked were not a significant source of research. The references that were eliminated as presenting less than three references to school plant planning over the ten-year period were spot checked and found to be fringe articles of dubious value to this study or, not infrequently, they were misreferenced by the indices or had been mistakenly included by the investigator of this study in the initial screening because of the ambiguity of titles. The topic "Environment," for example, could apply to the physical surroundings or to the emotional atmosphere created by the teacher, and the distinction could only be made by scanning the reference or eliminating the periodical from consideration by means of a cut-off as was done by requiring more than two articles during the ten-year span of the study.

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[1] For example, the best research report of the Shaker Heights school carpet experiment was in Noise Control, a periodical not indexed nor widely available.

Nature of the Literature

The architectural periodical literature contained a higher percentage of illustrative articles and collections of design award articles in proportion to the total number of articles than did the education references. This was not surprising in light of the emphasis placed on design ideas and on the dissemination or exchange of such ideas by architects and related technicians. Pictures, drawings, graphic illustrations, and diagrams are a much more necessary and vital part of the architectural profession and a much more practical and commonly used method of exchanging ideas. In some areas of design, these methods are the only means of communicating ideas.

The difference between the number of articles located in architectural sources and those located in educational sources is not so great when viewed in light of the fact that the educational sources were augmented by the Dissertation Abstracts. Without this singularly significant source, the ratio would be about two to one, with neither educators nor architects reporting any significant volume of identifiable research by means of the professional journals. Unfortunately, there is no publication similar to the Dissertation Abstracts to augment the periodical research in architecture. The Ph.D. in architecture is extremely rare, and the researcher in this profession often achieves his position by means of special training at the fifth year level and by means of special research interest and selection of his graduate design project. There is no known comprehensive listing of design projects published. Only one article in the periodical literature scanned stated that the author drew his material from his design project in a school of architecture.

Problems of Research

As was true when architects and engineers authored articles for educator-oriented periodicals, they also frequently presented charts, graphs and other technical materials in their own periodical literature in such a way that the appearance of the common tools of the trade took on the trappings of research findings. A technical "how to" article accompanied by several charts and graphs containing the necessary information for design or engineering calculations, not so identified, presents an impressive picture, although the trained reader might recognize the materials and content at first glance.

Again, as was characteristic of the educational materials, there were many excellent and valuable articles which were not research. One excellent source was the architect conference, a widely used method of disseminating new techniques, ideas, and findings. However, such conferences were frequently reported as edited dialogue of the participants, starting without much introduction and ending without summary or conclusion.

Similarly, many learned and informative articles began immediately on the core of the subject matter and ended without any summation or conclusion or, for that matter, without any type of recognizable ending--they simply stopped. Regardless of other merits, the reader is forced to conclude that they were written only to inform and were not research even though some resemblance to research was recognizable in the core of subject matter presented.

Review of the Research Located

The following articles were discriminated as research by the instrumentation of this study and have been classified in the categories indicated.

Sites. One study which dealt with the school site was located. J. R. Holmes and C. W. Chance[2] sought to provide guidance for planners who had to fix the permanent orientation of school buildings. This study presented information on a technique for checking the shielding of glass windows from unwanted sunshine. The researchers utilized about fifty Texas temporary school buildings facing all points of the compass. Using the Olgyay method, they mechanically measured the light in the temporary school buildings. For the purposes of the report, they presented only two comparisons, one very poor and one very good. The results, then, showed that by selecting proper orientation for this temporary type of building, school officials could obtain the efficiency rating of eighty-seven per cent instead of the poor rating of only twenty-nine per cent. The difference in the two ratings represented a large savings from unwanted heat. The authors found that there was a direct correlation between good orientation and lower temperatures. In a preliminary study of the building under similar conditions except for orientation, the authors reported temperature differences up to 13°F.

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[2] James R. Holmes and Clayton W. Chance, "School Building Orientation," American Institute of Architects Journal, 34: 69-72 (August, 1960).

Standardized Construction and Modular Planning. One of the most highly publicized research activities in the area of school architecture has been the School Construction Systems Development, otherwise referred to as SCSD. While many interim reports and other information on the project have been produced, only one has been presented in sufficient detail to be detected by the instrument as a report of research. This report was located in the Architectural Record and was titled "School Component Designs, Costs Revealed."[3] Although cost oriented, the project encompassed thermal, sonic, and flexible aspects of the program relating the project to the learning process in a direct manner. The focus of this study was to develop a component system for school construction. As reported, the technique was model testing and bidding. At the time reported, the nature of the findings were primarily descriptive of the features of the component parts and the costs that were bid for installing them.

General Planning and Design Factors. Two articles were reported that dealt with general design. The first article was by T. H. Creighton[4] and was titled "Most Like 'em Modern." Creighton reported an appraisal of new elementary schools in New Orleans, conducted by the New Orleans School authorities. Although fifteen schools were studied, only four of them were included in this report. Utilizing the questionnaire technique and reporting by percentage, the investigator ascertained that seventy-nine per cent of the teachers preferred their new school to the traditional school they had taught in, forty-one per cent of the teachers had no complaints, and fifty-six per cent found serious drawbacks. All of the features of the four new schools were not uniformly criticized by the teachers. In an article published by Architectural Forum, H. D. Hauf, W. F. Koppes and A. C. Green[5] reported on research sponsored by the State Education Department, the University of the State of New York. The research was accomplished by the authors at the School of Architecture, Rensselaer Polytechnic Institute at Troy, New York. While built around the theme of economy, the report discussed the value of many features of school construction which apply to the learning process. The report treated and evaluated the following topics:

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[3] Architectural Record, "School Component Designs, Costs Revealed," Architectural Record, 135: 166-172 (February, 1964).

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[4] Thomas H. Creighton, "Most Like 'em Modern," Progressive Architecture, 39: 278 (March, 1958).

[5] Harold D. Hauf, Wayne F. Koppes and Alan C. Green, "Economy in School Design," Architectural Forum, 125: 220-224 (May, 1959).

(1) single story vs. multi-story buildings, (2) campus plan vs. compact plan, (3) the use of repetitive units in planning, (4) the space module concept, (5) natural vs. artificial lighting, (6) perimeter length of exterior walls, (7) exterior walls, (8) interior partitions, (9) cost of casework, (10) thermal insulation, (11) prefabrication, (12) maintenance costs, (13) mechanical equipment, (14) heating and ventilating, (15) cost of control equipment, (16) plumbing systems, (17) economy measures: regulations and requirements, (18) state school design requirements, and (19) fire insurance rates.

The authors reached the following general conclusions. Some of the economy ideas offered little or no predictable savings. Some offered economies of small overall significance. Others were certain to reduce costs but only to an indeterminate extent. It appeared to the researchers that the source of greatest potential economies in relation to design would result from (1) wider use of modular planning, repetitive units, and off-site fabrication, (2) recognition of the importance of maintenance costs and consistent efforts to reduce them and (3) objective research as to the real needs in schools, aimed at reducing arbitrary but unessential requirements for structure and equipment.

Thermal Environment. The largest category of research reports was that of thermal environment. In an article that was cited in both the Education Index and the Art Index in

1956, Henry Wright[6] reported experiments on thermal equipment and design in a school available for test purposes. Mechanical equipment was either available or designed to gather the desired readings. The conclusions reached by technical consultant Wright included information that unit ventilators could heat end-on room additions and that blast heating was the simplest and most economical standby. Other factors about thermal comfort were discussed.

Three items on air-conditioning were discriminated as research by the instrument. All three were published in the period since 1961. The first of the three was a report of research by a Senior Editor of Architectural Forum, Jane Jacobs.[7] Editor Jacobs discussed the report of two schools (one air-conditioned and one not air-conditioned) that were compared in a Florida experiment with building costs and design. Data were gathered both from the costs and by mechanical means. Included in the findings was the fact that compactness of the floor plan saved so much on construction costs that the air-conditioned school cost $22,496 less than the non-air-conditioned school. It was pointed out that the saving was not possible without the air-conditioning because the extremely compact design of the school would then be intolerable.

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[6] Henry Wright, "Thermal Comfort Report," Progressive Architecture, 37: 142-152 (January, 1956). This article was one of three that were located in both the Education Index and the Art Index.

[7] Jane Jacobs, "Trial by Cooling," Architectural Forum, 115: 115-121 (August, 1961).

The results of a conference at the school by eminent school planners produced mixed reactions to many features of the school. There were disagreements among the conferees, but by no means an architect-educator split. Writing in Progressive Architecture in March of 1964, W. J. McGuinness,[8] in his column entitled "Mechanical Engineering Critique," cited sufficient material from a school air-conditioning study to merit consideration in this investigation. The report expressed current opinions of public school superintendents concerning the acceptance and efficiency of air-conditioning for elementary and secondary schools in the United States. The report compared figures gathered in 1960 with figures gathered in 1963, and included about 300 superintendents. By means of a questionnaire technique, the investigators discovered that the acceptance and use of air-conditioning had increased several times over in the period under consideration. Henry Wright,[9] probably the most avid advocate of school air-conditioning, writing in the Architectural Record of February 1964, reported a study on air-conditioning and its effects on school design. Wright had completed a survey of two-score architects and educators in seventeen states during the previous year. He utilized a tape recorder in the interviews and structured them as a free exchange of ideas.

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[8] William J. McGuinness, "School Air Conditioning," Progressive Architecture, 45: 174 (March, 1964).

[9] Henry Wright, "Air-Conditioning, Architecture and Education," Architectural Record, 135: 146-153 (February, 1964).

In summarizing his findings, Wright found the group generally against windowless "boxes" to save money for air-conditioning, in favor of interior courts, and willing to acknowledge that educational requirements were changing and thus demanded changes in architecture. Further findings included pro and con feelings on the campus plan with outside passages and agreement that flexible spaces are important. In general, however, Wright found no general overall trends.

In an earlier report in his column in Progressive Architecture, W. J. McGuinness,[10] of the Pratt Institute, reported a study dealing with the effects of insulation on the cost and quality of numerous roofs and walls. His digest indicated that the original study surveyed seven roof types and seven wall types. The study was conducted by using fourteen specialists on a panel, by inspecting schools, and by interviewing board members. In addition to the economic cost finding that increase in first expense through the use of any insulation is well repaid in savings over a thirty year period, the study also found that condensation on ceilings and comfort were important matters in considering the use of insulation.

Visual Environment. Two studies dealt with the visual environment. The first of these was reported in December of 1955, very early in the time span covered by this investigation.

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[10] William J. McGuinness, "Mechanical Engineering Critique," Progressive Architecture, 39: 9+ (April, 1958).

In this study, W. Allphin[11] evaluated the daylight received by typical desks in six New England schools. The study was experimental in nature and investigated six schools in northeastern Massachusetts and southern New Hampshire. The data were collected by mechanical measurement. Every hour the lights were turned off and students read a photo meter for a total of more than 5,000 readings. The readings were charted and plotted on a diagram. The investigator concluded that it was not possible to depend on outside light sources to eliminate artificial lighting. The study was found to be applicable to the middle New England and darker latitudes. Efforts to reduce costs by dividing the light load between artificial and natural sources were not recommended.

F. K. Sampson[12] reported sufficiently on the work of Doctor H. Richard Blackwell to merit inclusion in this study. Writing in the American Institute of Architects Journal in October of 1960, Sampson reported on Blackwell's effort to determine how the eye sees a standard test object, and then to relate this laboratory data to field conditions of "moving" eyes and differing details of various school tasks. Blackwell's research was experimental in nature and his data were collected by optical and mechanical apparatus. His findings, which have been evaluated as quite important by some, indicated that tasks having good contrast require low levels of illumination and that those having poor contrast need much more than a proportional increase in illumination. Blackwell's findings further indicated that lighting specifications and surrounding surfaces provide a basis for determining proper levels of illumination for classrooms.

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[11] Willard Allphin, "Daylight Measurements: Six New England Schools," Progressive Architecture, 36: 110-114 (December, 1955). This article was one of three that were located in both the Education Index and the Art Index.

[12] Foster K. Sampson, "Effects of Teaching Equipment and Supplies on Visual Environment," American Institute of Architects Journal, 34: 86-88 (October, 1960).

General Planning and Design Factors. In a staff article in January of 1956, Progressive Architecture[13] reported more generally on the experiments conducted at the Washburn school previously mentioned by Henry Wright in an article on thermal environment at that school. The purpose of the study was to effect economy with no impairment of teaching efficiency, weighing and isolating factors that contribute an economical school-building solution--in classroom planning, in structure and use of material, in fenestration, and in equipment. Washburn school consisted of one original building and two additions, one addition being a side-on addition and the other an end-on addition. It was the finding of the study that the end-on addition was cheaper and more satisfactory, more flexible.

Physical Education Facilities. In a 1962 Architectural Record article, Nicholas L. Engelhardt, Jr.[14] reported a

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[13] Progressive Architecture, "Auburn, Washburn School Problem--Super Test School," Progressive Architecture, 37: 137-141 (January, 1956). This article was one of three that were located in both the Education Index and the Art Index.

[14] N. L. Engelhardt, Jr., "Search for a Solution: Physical Education," Architectural Record, 131: 138-145 (February, 1962).

"Search for a Solution: Physical Education." Engelhardt focused on two questions. Is youth receiving sufficient physical education to prepare it for its responsibility? Is the cost of physical education facilities in proper proportion to its educational value? Engelhardt surveyed the educational facilities of eight schools. He charted the physical education areas and made diagrams of the physical education sections of the buildings. After reviewing recommended physical education facility dimensions and his data, Engelhardt concluded that, because of the wide variation in the point of view toward physical education facilities in various communities, there was no standard solution to the problem but that the matter needed further study.

Large and Small Group Instruction Areas. One of the basic problems of research in architecture is the very high cost of building an experimental structure. This was done in a project at the school of architecture at Rensselaer Polytechic Institute and was reported by Alan C. Green[15] in an article titled "New Spaces for Learning" in the American Institute of Architects Journal. The test classroom was utilized as a college facility, but the experimentation with multimedia teaching facilities has a more universal application. The classroom was built as an experiment and was evaluated by means of observation. In the experimental phase of the research, the construction of the room was such that walls and other features could be changed around to try different solutions to problems. At the time of reporting, the findings were favorable but incomplete. The classroom was reported as a successful blending of design with developments in aids and media.

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[15] Alan C. Green, "New Spaces for Learning," American Institute of Architects Journal, 38: 45-48 (September, 1962).

Demountable Facilities. Another report of the demountable space frame of the Unistrut structural system was presented in a July 1955 edition of Architectural Forum.[16] This early experiment with standardized structures was designed to be an economy move but also developed into the area of flexible learning facilities. An experimental structure, which was designed under the direction of C. Theodore Larson, professor of architecture at Michigan, was erected. The frame was subject to mechanical testing and many of the other features of an educational structure were tested in the pilot building. The research resulted in a building design that provided for rapid erection, demountability, putative economy, and easy maintenance as well as a well-designed classroom cluster with a single core for facilities.

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[16] Architectural Forum, "Demountable Space Frame," Architectural Forum. 103: 140-147 (July, 1955).

CHAPTER VI

FINDINGS OF THE STUDY

In the previous two chapters, attention was centered on the two bodies of professional literature. Chapter Four was devoted to a discussion of the periodical literature in education and a summary of the research articles. The same procedure was followed with the architectural literature in Chapter Five. It is the purpose of Chapter Six to bring the research articles of the two separate fields together and to present an evaluation. In addition, conclusions, observations, and recommendations are presented.

Synthesis of the Research

One of the purposes of this study was to bring together the literature in the two fields in such a form that it might be evaluated. To accomplish this, the research articles were presented so that they could be observed in their relationship with one another and so that the strengths, weaknesses and problems of the research associated with the periodical literature could be analyzed.

Development of the System of Classification. An early review of the nature of the research in school plant planning indicated either that the periodical literature was a rather meager source of school plant research or that there was only a small amount of school plant research. Assuming either or both possible problems, it was apparent that there probably was not sufficient available research in school plant planning to develop a satisfactory system of classification. It was then deemed best to initiate the classification scheme through the use of the general total body of the school plant literature and from there to refine and condense the classification by adapting it to the research located.

The first step was to separate out the "open house" and design award collection type of article. This process left 1,071 articles from the general periodical literature and 154 from the American Doctoral Dissertations. The 1,225 reference cards representing these articles were sorted and resorted until a pattern began to develop. The piles of cards were combined or divided until a natural breakdown was established. It was assumed that the general literature would represent all of the important areas--that it would present the areas of interest, the problem areas, and the areas of general plant planning concern. Since the bulk of the literature was collected under the general topic of school plant planning, the resultant system of classification was much broader than the topic of this investigation. This broad system of classification was later used to present the classified references to periodical literature--all of the articles uncovered by this investigation--in an appendix to this study.

The classification scheme was inspected and it was determined that the arrangement could easily be modified for classifying the research located by this investigation.

In order to focus more precisely on those items of research that related directly to the learning process, both the first and the last parts were eliminated from the initial outline of classification. (The classified guide to periodical school plant literature, presented in an appendix to this study, follows this outline.) In addition, some of the single items within the remaining portion of the outline were eliminated or combined with other items. The classification system was further modified by inspection after the research literature had been sorted according to it.

The final scheme kept the same numbering system as the initial, comprehensive outline. The categories eliminated at either end of the outline were removed with the knowledge that some of the articles to be ordered by the outline might be directed toward, for example, economies or cost comparisons and still relate directly to the learning process. It was determined by a trial sort that articles that would normally be sorted into the general, financing, construction, evaluating, or miscellaneous categories could also be included in the organizing and planning categories if they bore "a relationship to the quality of the environment which is [was] provided for the learning process."

The resultant classification system was as follows:

- 4000 ORGANIZING FOR PLANNING
    - 4010 Planning Procedures
    - 4020 Community Involvement
    - 4030-4040 Architect and Consultant Services

5000 PLANNING NEW SCHOOL PLANTS

- 5010 Sites
- 5020 Educational Specifications
- 5030 Building Layout
- 5040 Standardized Construction and Modular Planning
- 5050 Flexibility
- 5060 Size and Capacity
- 5080 General Planning and Design Factors
- 5090 Environmental Considerations
  - 5091 Spatial
  - 5092 Thermal
  - 5093 Sonic
  - 5094 Esthetic
  - 5095 Visual
  - 5096 General Environment
- 5100-5110 Special Purpose Planning--Instruction
  - 5101 Instructional Materials Area and Library
  - 5102-5113 Special Purpose Classrooms
  - 5114 Large and Small Group Instruction and Team Teaching
- 5120 Special Purpose Planning--Auxiliary to Instruction
  - 5121 Auditorium and Theater
  - 5122 Cafeteria and Kitchen
  - 5123 Guidance
  - 5124 Central Office

CHART I

This chart contains all of the references found in the two previous Chapters to which have been added 14 references from the AIA Research Survey and the non-abstracted references from American Doctoral Dissertations which were judged by title to be applicable. In some instances the categories have been condensed and some references applicable to more than one category have been shifted if the original category was eliminated.

KEY: (D) Dissertation (Not Abstracted); (P) Periodical Article

(DA) Dissertation (Abstracted); (RS) AIA Research Survey

4000 ORGANIZING FOR PLANNING			5000 PLANNING NEW PLANTS
4010 (14 Items)	4020 (0 Items)	4030-4040 (0 Items)	5010 (1 Item)
Planning Procedures	Community Involvement	Architect and Consultant Services	Sites
(DA) "Educational Planning for School Plant Construction." Whigham			(P) "School Building Orientation." Holmes and Chance.
(P) "Educational Planning of the School Plant." School Executive			
(P) "Who Does the Educational Planning for your School?" Hummel			
(DA) "Educational Planning Procedures for School Building Construction." Hummel			
(DA) "An Appraisal of Teacher Participation in Secondary School Planning." Lee			

Planning Procedures, cont.

(DA) "The Development of Guidelines As To the Role of the High School Principal in Planning a Secondary School Building." Larson

(DA) "A Comparative Investigation of the Role Educational Planning Plays in Determining School Plant Design for Elementary and Secondary Schools in the State of Delaware." Hoerner

(DA) "An Analysis of School Plant Planning in Selected Districts in Washington and Certain Other States." Terjeson

(DA) "The Effectiveness of Procedures Used in School Building Programs in Nebraska." Keating

(DA) "Relationships Between the Comprehensiveness of School Plant Planning Procedures and the Quality of Resultant School Plants." Campbell

(P) "Are Double Sessions Students Penalized Academically?" Hanhila

Planning Procedures, cont.

(D) "A Procedure Guide for School Plant Construction for the State of Wyoming." Foreman, Charles M. (56-7)

(D) "A Mathematically Sound Hypothesis for Estimating Future School Enrollments." Di Paola, Peter P. (55-6)

(RS) "The Planning and Design of Facilities to House the Current Trends in Instructional Methods and Techniques." Green & others

5020 (2 Items) Educational Specifications	5030 (2 Items) Building Layout	5040 (4 Items) Std. Construction & Modular Planning	5050 (4 Items) Flexibility
(DA) "The Essential Elements of Educational Specifications for School Plant Facilities." Roaden	(D) "The Schools Within A School Plan." Hodgson, John A. (58-9)	(P) "School Component Designs, Costs Revealed." Architectural Record	(P) "Demountable Space Frame." Architectural Forum
(D) "Educational Specifications for a Proposed New Senior High School Building for Caldwell-West Caldwell, New Jersey." Monez, Thornton B. (58-9)	(D) "The Schools Within A School: A Study of Selected Secondary High Schools That Embody This Plan." York, William J. (58-9)	(RS) "Development of Standard and Correlated Dimensions of Material Components: "School Construction." Turner	(P) "Demountable, Low Cost Elementary School." Hsiao

		Std. Const., cont.	Flexibility, cont.
		(RS) "School Construction: Systems Development." Ward	(RS) "Attwood System of Demountable Space-Frame Building Construction." Larson
		(RS) "A Structural System for Prefabricated School Buildings." Goody and Schiffer	(RS) "School Building Types." Seymour
5060 (17 Items)	5080 (24 Items)	5091 (0 Items)	5092 (10 Items)
Size and Capacity	General Planning and Design Factors	Spatial Environment	Thermal Environment
(DA) "A Technique for Determining the Operating Capacity of Secondary School Buildings." Conrad	(P) "Random Falls Idea: An Educational Program and Plant for Youth and Community Growth." Shaw & Reid		(P) "Thermal Comfort Report." Wright
(DA) "Space Allocation, Pupil Capacity and Unit Cost of Twenty Selected Public Secondary School Buildings Constructed in Indiana During 1948-1958." Fuller	(P) "New High School." Smith & Shaw		(P) "Trial by Cooling." Jacobs

Size & Capacity, cont.	Gen. Planning, Cont.	Thermal Environment, cont.
(DA) "A Comparison of Four Formulae for Rating Pupil Capacity of School Buildings in Selected Secondary Schools in the State of Pennsylvania." Gatski	(P) "All-Age School." American School and University	(P) "School Air Conditioning." McGuinness
(DA) "Scholastic Achievement at Iowa State College Associated with High School Size and Course Pattern." Lathrop	(P) "School Plant Design and the Instructional Program." Kyzar	(P) "Air-Conditioning, Architecture and Education." Wright
(DA) "An Analysis of the Relationship of Size of Arkansas High Schools and the Achievement of College Bound Seniors." Smith	(DA) "A Comparison of Instructional Practices in Classrooms of Different Design." Kyzar	(P) "Mechanical Engineering Critique." McGuinness
(DA) "A Study of Size-Cost-Achievement Relationships in Reorganized School Districts of Wisconsin." Bragg	(DA) "An Analysis of the Impact of Program Change on School Plants." Bergstrom	(DA) "A Study of Factors Involved in Establishing a Satisfactory Thermal Environment in the Classroom." Mincy
(DA) "An Analysis of the Relationship of Accreditation, Finance and Size of Nebraska High Schools to Scholastic Achievement." Jantze	(DA) "A Survey of Construction Features Found in 325 New Elementary School Buildings." Phillips	(DA) "The Effect of Thermal Environment on Learning." Peccolo

Size & Capacity, Cont.

(DA) "Relationship in the Elementary School Between Size, Per Pupil Cost, and the Extent of Educational Opportunity." Teets

(DA) "An Investigation of Certain Factors Influencing the Optimum Size for Elementary School Attendance Units." Basler

(DA) "Elementary School Size Relationships." Leavitt

(DA) "The Relationship of Size and Organizational Type to Certain Factors in Alabama's White Junior High Schools." Crocker

(P) "Is There An Optimum Size High School?" Livingston

Gen. Planning, cont.

(DA) "Desirable and Understandable Building Features and Spaces in Selected Elementary Schools." Bohn

(P) "What Schoolmen Want In Buildings." Nation's Schools

(P) "Most Like 'em Modern." Creighton

(P) "Space Allocation in Washington High Schools." Hayes

(DA) "A Study of Space Utilization and Unit Costs of 75 Elementary School Buildings Constructed in Indiana During 1948-1954." Lucht

Thermal Environment, cont.

(P) "Two Studies on Thermal Environment and Learning." American School Board Journal

(P) "What Does School Air Conditioning Cost?" Wright

(P) "A Definitive Experiment with Air Conditioning." Wright

Size & Capacity, cont.	Gen. Planning, cont.
(DA) "A Study of Optimum Size of Secondary Schools." Smith	(RS) "Identification and Evaluation of Potential Economies in Public School Construction." Koppes, Green, & Hauf
(DA) "A Study of the Relationship Between Size and a Number of Qualitative and Quantitative Factors of Education in Four Sizes of Secondary Schools in Iowa." Gray	(RS) "School Obsolescence and School Financing." Bennet and Others
(P) "What Size High School?" Mayo	(P) "Economy in School Design." Hauf, Koppes and Green
(D) "High School Size: Its Relationship to Selected Educational and Cost Factors." Brown, William E. (57-8)	(DA) "Space and Cost Allocation for Service, Administrative and Instructional Areas in Selected Elementary and Secondary Schools." Salisbury
(D) "An Attempt to Determine the Optimum Size of Public Secondary Schools." Menozzi, John C, (59-60)	(DA) "Pupil Control Factors to be Considered in Planning School Plants for the Grossmont (California) Union High School District." Wenbourne

Gen. Planning, cont.

(DA) "The Development of Educational Criteria for New Elementary Schools in Chicago." McNicholas

(DA) "General Factors Related to the Educational Specifications for the Physical Facilities of the Small Twelve-Year School (Grades K-12)." Yulo

(P) "Panorama of 100 New Schools." Gibbons & Hereford

(P) "Let's Take a Look at New Schools." Pillard & Gibbons

(P) "Planning and Operating the Middle School." *Educational Executives' Overview*

(D) "A Study of the Problem of the Allocation of Spaces in New High Schools to Meet the Needs of Various Departments." Webber

(D) "A Study of the Functional Aspects of the Modern School Classroom." Goetschius, Donald G. (56-7).

5093 (2 Items)	5094 (4 Items)	5095 (10 Items)	5096 (6 Items)
Sonic Environment	Esthetic Environment	Visual Environment	General Environment
(P) "School Carpet--Does It Make Sense?" Nabors	(P) "Group Differences in Color Choice and Rejection." Pasto & Kivisto	(P) "Daylight Measurements: Six New England Schools." Allphin	(P) "Auburn, Washburn School Problem; Super Test School." *Progressive Architecture*
(DA) "A Study of Factors Involved in Establishing a Satisfactory Acoustical Environment in the Classroom." Womack	(P) "Effect of Color Illumination Upon Perceived Temperature." Berry	(P) "Effects of Teaching Equipment and Supplies on Visual Environment." Sampson	(DA) "A Study of Attitudes and Feelings Toward Windowless Classrooms." Chambers
	(DA) "A Study of the Effect of Classroom Color on Student Achievement." Rudner	(P) "Are Modern Classrooms Lighted for Better Learning?" Harris	(DA) "Influence of School Plant Upon Personality Ratings of Elementary School Children in the New York City Public School System." Gang
	(DA) "A Study of Color in the Classroom Environment." Johnson	(DA) "A Study of the Visual Environment in Selected Classrooms." Acuff	(RS) "Effect of Environment on the Learning Process." Larson and Others
		(P) "Predetermination of Natural Illumination by the Model Testing Method: Research Report 8." Pena	(RS) "Environmental Case-Study: The Effect of Windowless Classrooms on Small School Children." Larson, Fox, and Others

Visual Envir., cont.	Gen. Envir., cont.
(P) "Manufactured Light vs Daylight for Schoolrooms." Hammel & Johnson	(RS) "A Study of the Relationship Between the Design of High School Building Design and Student Learning." Myrick & Marx
(P) "Measurements in Daylighted Classrooms in Arizona." Williams	
(P) "Acrylic Louver Wall Panels for Classroom Daylighting." Linforth	
(P) "Research Establishes Proper Ratios for Brightness Contrast, Need to Shield Light Sources, and Methods and Materials to Minimize Glare." Crouch	
(RS) "Development of a Model System for Study of Light and Color in Architecture." Peters, Pollack & Hasenstab	

5101 (0 Items) Instructional Materials Area & Library	5102-5113 (6 Items) Special Purpose Classrooms	5114 (6 Items) Lg. & Sm. Group Inst. and Team Teaching	5121 (0 Items) Auditorium & Theater
	(P) "Search for a Solution: Physical Education." Engelhardt	(P) "New Spaces for Learning." Green	
	(DA) "The Use and Functions of Multipurpose Rooms in Santa Clara County, California." McDougall	(DA) "Planning, Design, and Use of Large Group Instructional Units." Roemmich	
	(DA) "Multi-Purpose Units in the Elementary Schools: Appropriate Activities and Required Facilities." Martin	(P) "From Research to Mock-up in Three Years." Audiovisual Instruction	
	(P) "Secondary School Facilities: Recent Construction--How Effective?" Munch	(P) "Indiana's Audio-Visual Research Center." Martin	
	(DA) "Planning Social Studies Facilities for the Secondary Schools." Ovard	(RS) "Definition of Appropriate Components for Rear Projection Systems." Caravaty	

	Special Purpose Classrooms, cont.	Lg. & Sm. Group Inst. and Team Teach., cont.
	(D) "Planning Facilities for Secondary Art Rooms." Burley	(RS) "Development of Detailed Planning Criteria for Group Instructional Facilities Utilizing Aids and Media." Koppes, Green, and Gassman
5122 (0 Items)	5123 (1 Item)	5124 (2 Items)
Cafeteria & Kitchen	Guidance	Central Office
	(DA) "Relating Guidance Philosophy to Function: A Study of the Location of Guidance Facilities Within the School Plant." Parker	(DA) "Planning Central Office Facilities for Local School Districts." Richardson
		(DA) "The Influence of the Location of the Superintendent's Office on the Educational Administration Complex." Chaffee

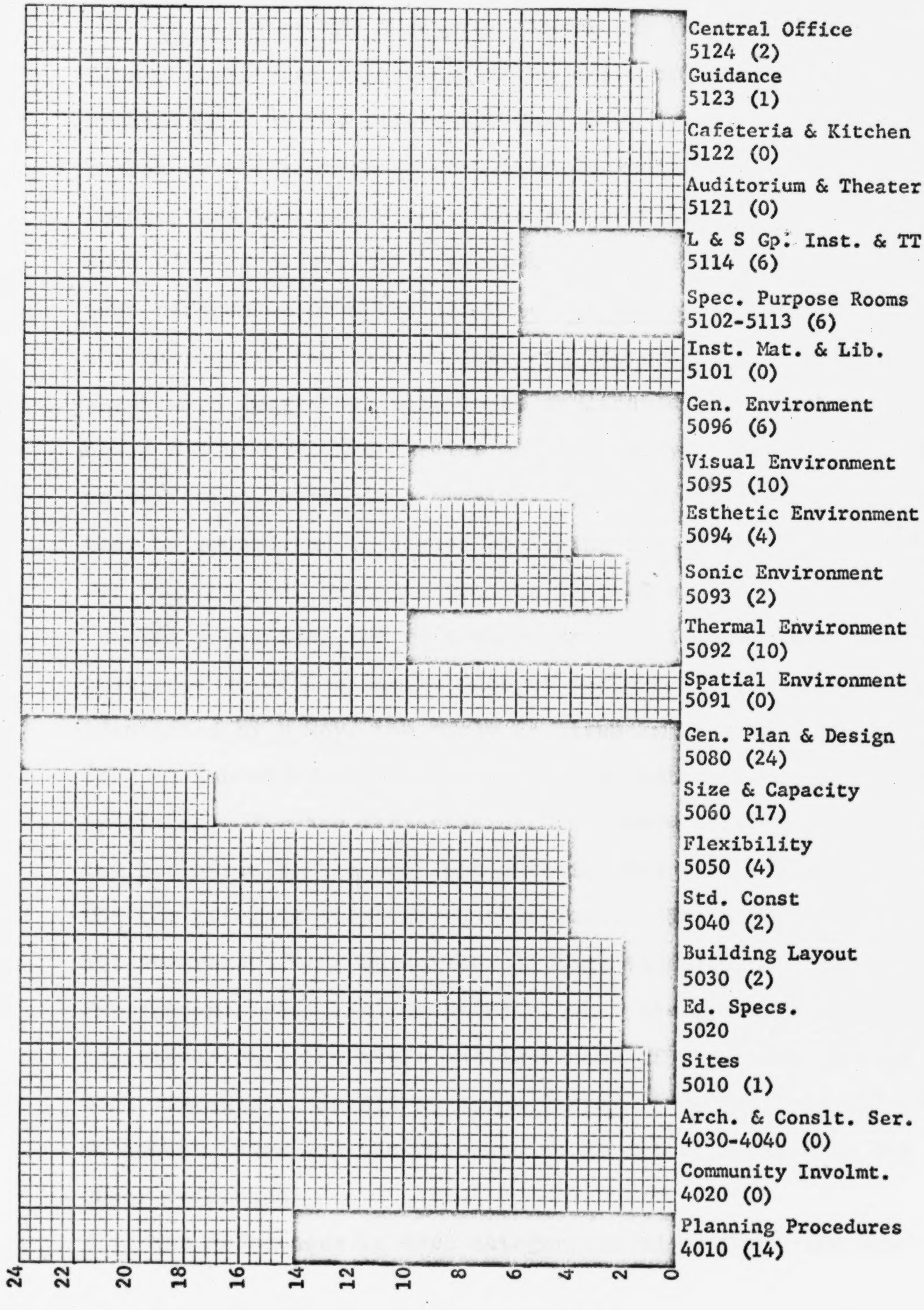

CHART 2. GRAPH OF RESEARCH CATEGORIES

Classifying the Research. Chart One presents the research classified according to the above outline. The chart presents all of the references that were identified as research by the instrument developed for this purpose (described in Chapters Four and Five). The research items for the purpose of this classified presentation were augmented by fourteen references from the AIA Research Survey and by ten non-abstracted references from American Doctoral Dissertations which were judged by title to be applicable. These references could not be included earlier in this study because they lacked sufficiently complete details. However, it is important that they be considered by anyone reviewing the literature and have, for that reason, been included in Chart One.

As presented, the references provide only minimum information because of the limitations of the chart. The source is identified by a key, the title is given in full and, except for the non-abstracted references, the last name of the author is listed. For the dissertations that were abstracted and for the periodicals, the complete citation was footnoted in one of the two previous chapters of this study. For the dissertations not abstracted, the author's full name is given, followed by the academic year, in parenthesis, when the dissertation was reported. Only the title and last name of the researcher(s) were listed for the AIA Research Survey since that source has an author index and the information is not applicable to any other reference.

The references in each category cited on Chart One are not necessarily exhaustive but rather represent careful scrutiny of the sources stipulated in the design of this study. While many of the references clearly fall into one or another of the classifications, there are some which would fit equally well into more than one category. Within each category, the references are grouped if a natural pattern could be determined.

On the page following the classification system, the number of items is presented in graph form as Chart Two. The graph presents the relationship of the amount of effort or lack of attention that exists among the subject areas classified.

Evaluation of the Research Available. From the graph it would appear evident that there are discrepancies in the order of priority given research attention and that some areas have not been dealt with in spite of their importance. It is also evident that not all categories are of equal or even nearly equal importance in the amount of attention merited.

The singularly significant bar on the graph is not unexpected. The general planning and design factors category is in some respects a "catch-all" category and as such does contain a large number of research items. There does not appear to be a pattern from the listing of the research references and there is no large concentration of studies within this category.

The second largest category, size and capacity, while probably not the most important of the classifications, is one that has received a considerable amount of attention during the ten-year period under consideration. It also has characteristics which may be more measurable than the characteristics in some of the other categories. Four of the endeavors dealt with capacity and thirteen dealt with size--most of the studies sought to compare size or capacity with one or more related factors, such as achievement, cost, and educational opportunity.

The third largest category, planning procedures, presented fourteen pieces of research. Again, there was no pattern. The category is characterized by general considerations of planning procedures and a scattering of other considerations.

The six categories that cover the research in environment could be ranked from ten items of research down to no research. Two of the environment studies recorded ten research reports each--thermal environment and visual environment. Seven of the ten thermal studies dealt with heating and air-conditioning and just three treated the general topic of the effect of thermal environment on learning. General environment was third among the environment studies with six research reports, followed by esthetic with four, sonic with two, and spatial with none. Central office, guidance, building layout, educational specifications, and sites each contained just one or two reports and at least several of them are of such importance that they merit more consideration than they received. Six categories were vacant. Several of the six will probably never achieve a record of high popularity nor merit extensive consideration as they do not relate strongly to the learning process; however, spatial environment, instructional materials areas, and, possibly, auditorium and theater should receive much more attention than they have. Auditorium has received a notable amount of attention in the area of design, but this area was not identifiable as a research characteristic by the criteria of this study.

Summary of the Study

The field of school plant planning research was surveyed, and it was determined that there were several possible sources of research materials. One possible source was doctoral dissertations; this source had been subjected to some prior investigation and was accessible through abstracts and comprehensive listings. Another source was libraries and collections; with the exceptions of some bibliographies and other lists, little information was available as to the quality and quantity of materials accessible through this source. A third source was the periodical literature; insofar as could be determined, this was a neglected source and was accessible, at least for the principal periodicals, through adequate indices.

Initial investigation indicated that library collections were noticably lacking in the type of literature that reported research findings, although such prominant items as The Educational Facilities Laboratories reports were available. A series of letters indicated that there was no real access to the pamphlets, monographs, mimeographed reports, and other "scarce" forms of reports that were in scattered private collections or in research centers. The letter responses would not encourage the hope of finding any amount of this type of material in accessible locations, systematized so that it could be used. Subsequently, it was decided to explore the periodical literature in the professional journals and the related periodical sources, and to add to this source the Dissertation Abstracts. It was further determined that the study should focus on the facilities as they relate to the learning process.

The periodical literature was surveyed in both the Education Index and the Art Index and all possible topics and all titles were recorded on prepared cards. Other information was also recorded. The cards were placed in chronological order by periodical and the articles were scanned by the researcher. A specially prepared instrument was used to determine if sufficient research characteristics were present to classify the reference as an original research report, or, if the article reported a research activity in sufficient detail to be included in this investigation. Thirty-three educational periodical articles and fifteen architectural periodical articles were identified in this fashion. Three of this total were cross-referenced duplicates. The remaining articles were divided into two classifications at this point--those which were not research but which were school plant literature, and those which were "how we /they/ built a school building" or collections of designs or design competitions.

All of the articles, including the research, were combined in an extensive reference guide to school plant periodical literature, with the design collection and reports of new schools forming a "portfolio of schools" at the end of the listing. The collection consisted of 2,188 articles and abstracts and is found in an appendix to this study. In addition, the research articles were combined with the doctoral theses that were reported in the Dissertation Abstracts and were recorded on a standardized form for consistent analysis of the available information about each item of research. Initial investigation had indicated that perhaps about one periodical article in one hundred might prove to be identified as research. In the final analysis the figure proved to be closer to one item in fifty. A larger number of articles discussed research that was being conducted but not in sufficient detail or in a manner to be useful to this study.

The research was sorted according to a system that was worked out using the larger lot of all of the periodical articles--the system was then refined and condensed to report the research literature. After sorting, the standardized form for recording the essential information was utilized to report the information in narrative form. After the literature was reported separately for each discipline, the titles were combined and were supplemented by two additional sources--the applicable school plant planning references from the AIA Research Survey and the non-abstracted titles from the Dissertation Abstracts. These 115 references were sorted according to the system of classification and were briefly identified in a chart form. The total number of each category was placed on a bar graph. The literature was discussed with reference to the chart and the graph.

Evaluation of Procedures

The following conclusions constitute the investigator's appraisal of the procedures for this study:

1. The Education Index was a reasonably accurate index to the periodical literature that it classifies. Spot checks of complete volumes of periodicals indicated nearly total coverage on major periodicals for school planning.
2. The Art Index was a reasonably accurate index for the periodicals that it classifies; however, it did not provide complete coverage of the peripheral periodicals. Spot checks of complete volumes of major periodicals indicated nearly total coverage for school planning.
3. The card system for organizing the references proved to be efficient, accurate, and easy to use. In a more extensive endeavor, computer cards or punch cards would be essential.
4. The instrument for identifying research demonstrated both success and shortcomings. It did identify research and reports of research as it was devised to do, but it possessed no qualitative characteristics

and selected short summaries as well as extensive full-blown projects. The instrument was still difficult to apply in borderline cases.

5. The survey sheet for gathering information from which to evaluate research findings was a satisfactory instrument but failed to fully achieve its intended purpose because of the nature of the literature that it was used to evaluate. Periodical articles and the Dissertation Abstracts simply did not state the information at all or stated it indirectly, requiring surmise and interpretation by the investigator.

Adequacy of the Research Disclosed

In general, the research revealed in this study agreed with the items of research reported in other reviews of research publications. Some discrepancies, however, were noted. The coverage was nearly duplicated insofar as doctoral theses were concerned. It was found that the published reviews of research classified some of the articles as research and the instrument designed for this investigation did not agree with that classification. Consequently, several of the items of this type were placed in the general literature classification by this investigator. The reviews of research also included some research studies that were unpublished or were from more less accessible sources, probably included because of specialized knowledge of the person responsible for the authorship of the review.

Insofar as the centers of research activities were concerned, the periodical literature and consequently this investigation did not satisfactorily reveal the research they have conducted. While not reported in full, the Educational Facilities Laboratories activities and the School Construction Systems Development project received at least adequate coverage in the literature. This coverage was not of the detail that was demanded by the instrument for this investigation. The other research centers received less coverage. No adequate explanation was found for this shortcoming of the major periodical sources.

Conclusions

In response to the questions raised at the beginning of this study, the following statements represent the conclusions of the investigation:

Question One: What is the nature of the research in school plant design which has been conducted by educators and architects during the decade 1955-1964?

1. The amount of research reported in the periodical literature as revealed through this study was not of sufficient volume to evaluate the nature of the research in school plant design by architects.

2. The amount of research reported in the periodical literature as revealed through this study was not of sufficient volume to evaluate the nature of the research in school

plant design by educators. The methodology of the research located through the Dissertation Abstracts did indicate that the survey was still the predominent type of research used. Only one historical dissertation per se was revealed. A marked trend was noted toward an increasing use of the jury system, generally evaluated against the literature or against a questionnaire. About one-third of the dissertations were of a regional or local-district survey type.

3. There appears to be no organized pattern to the research conducted by architects and educators during the period covered by this study and, at the present time, little if any organized pattern exists in either discipline. Research appears to be motivated by individual or institutional interest and by funds available, which often specify the area to be investigated.

Question Two: What are the patterns of strengths and weaknesses of existing research by educators and architects and how may they be utilized to give appropriate emphasis and direction to future research endeavors?

1. Due to the limited number of articles revealed by the study, an established pattern of strengths and weaknesses was not evidenced except that research appears to be moving principally in the areas where some sort of mechanical testing or measurement is possible and in areas where funds are available. For the most part, the pattern of research appears to be undirected.

2. From the limited research available, it appears that

there is very little if any evidence of overlap or disagreement between educators and architects in the research literature. The relationship seems cordial but distant.

3. The research efforts of educators and architects neither meet nor mesh sufficiently at the present time to give direction to future research endeavors. Present relationships appear to offer little more than a precedent for future meetings on which a well directed effort may be based. The work of the Educational Facilities Laboratories appears to contribute to this end.

4. The classification of the research in this study indicates that there probably is a basic pattern of background and professional responsibility whereby it should be possible to define spheres of competency and responsibility in school plant planning and research so that the task areas attributable to each discipline might mesh.

Question Three: Does an analysis of the basic patterns and relationships of existing school plant planning research by educators and architects suggest a logical and useful classification of such research?

Such a classification was a product of this study. It was organized, however, by means of a preliminary procedure that first utilized the larger body of school plant planning literature which was subsequently refined by application to the research literature. The research literature as revealed by this investigation was not of sufficient significance to produce its own classification without the aid of the larger body of literature.

Secondary Question

As a part of this investigation, an attempt was made to determine research effects of educators and architects on each other by tabulating the authorship of the research articles and the authorship of the literature at large in the periodicals of the two disciplines. There were four possible arrangements--authorship by an educator, authorship by an architect, authorship by one or more of each, and no authorship indicated (or authorship by an author unrelated to either field). The latter category was assumed to include a large number of articles written by one or more members of a magazine's staff.

Excluding the dissertations, all of which were in the field of education, there were a total of 2,034 periodical articles revealed by this study. Seven hundred forty-one were authored by educators, four hundred seventy-eight were authored by architects, seven hundred forty-three were by unnamed authors, and seventy-two were co-authored by a combination of an educator and architect or technician.

Dealing solely with the research, twelve articles were authored by educators (one in an architectural periodical), twenty were authored by architects (six in educational periodicals), nine were not identified (six education and three architect), and four were co-authored (all in an educational periodical).

In the general literature, excluding the "how we did it" articles, four hundred forty-nine articles were educator-authored, three hundred twelve were architect-authored, two hundred forty-one were not identified, and twenty-four were authoried by a combination.

With regard to the collections of school descriptions, about half were not identified as to authorship (four hundred ninety-three), two hundred eighty were produced by educators, one hundred forty-six were accomplished by architects, and forty-four were a cooperative effort.

In general, there was a trend in the direction of having architects author articles for educational periodicals; this was not reciprocated. Only twenty-four articles by educators and one cooperative effort appeared in architectural periodicals. On the other hand, three hundred forty-five architects appeared in educator periodicals. A large number of staff articles were found in the architectural periodical literature.

Observations

The following observations were made as the result of this study:

1. The available periodical professional journals in the fields of education and architecture are not contributing significantly to the promotion, evaluation and dissemination of research in the field of school plant planning in proportion to what would appear to the investigator of this study to be their obligation.

2. The obligations of researchers in the disciplines of education and architecture have not been well defined nor well organized and this discrepancy has manifested itself in a most apparent manner with the rapid developments in educational trends over the past decade.
3. With some notable exceptions, both architects and educators have demonstrated a certain inflexibility and reverence for past practices which have not been justified in any reliable fashion. There has been more effort at trying to define research to fit what people are doing than to conduct research.
4. There is a certain characteristic problem of working with public property which keeps research from becoming as important a facet of school design development as it might well deserve. There is a lack of money for research, a conservative public attitude, and the dimension of permanent investment that resist experimentation. In addition, there has been a tendency to utilize these facts as reasons for not moving ahead at a faster pace.
5. There is a definite lack of common ground, in spite of a common basic problem, between educators and architect. The most significant reason behind this shortcoming is the conceptual difference underlying the philosophies and practices of the arts and the sciences, or their adaptations to the

two disciplines herewith under consideration. To try to arrive at some consensus by means of conferences and other discussion meetings is to attack the problem in the middle. No known attempt to close this gap in an applicable organized study was located, although the architectural profession has thought along the lines of defining esthetic research.

Recommendations

1. From the standpoint of strengths and weaknesses of research in the two disciplines under consideration in this investigation, no topic for potential research has yet been treated extensively enough and, hence, no recommendation for focus of research is here attempted. Research is needed in all areas. In particular, there is an early basic need for research in the philosophical relationship between education and architecture and a need for a study of ways and means for improving present relationships. This need is just as real, if not more real, than the need to study the effect of the educational structure on learning.
2. A by-product of this study was a realization of the disorganized state in which research in school plant planning is functioning. It cannot be recommended strongly enough that a central agency be designated and financed to collect, abstract and disseminate the

research literature in school plant planning. The problem has been recognized and solutions have been attempted, but as of the present writing no recognizable progress has been made.

3. It is recommended as a result of this study that a concerted effort be made to set up channels to actively pursue funds for research in school plant planning. The present sources, which are primarily from the government with some from private foundations, do not begin to compare with the research and development funds necessary to keep pace.
4. As a result of this investigation, it is suggested that additional organizations are necessary. Such organizations should encompass both the fields of education and of architecture. Organizations that are a by-product of other organizations and need to beg for the attention of the few active participants will probably continue to be only sporadically effective.
5. It is recommended that more and better publicity be given to the research that is accomplished in the field. Abstracting and publication of worthy research efforts is essential and presently lacking.
6. Finally, it is recommended that more dissertations and graduate design projects which are worthy of the attention of the practitioner because of their generalizability be published in the professional

journals of both fields. Graduate departments could encourage this by requiring students to submit abstracts of their work. As publication was once a doctoral requirement, at least a resulting published article could be encouraged, if not required.

Postscript

In the course of this study, the investigator came across an observation by Archibald B. Shaw which seemed to sum up several of the central problems of the study:

> The architect joins us, listens to what we say. He reads things like Dr. Conant's report; the Trump reports; maybe even reads the Random Falls Idea and "Q-Space" and the EFL reports. But just when he gets enthusiatic, we back away. We talk about economy, community acceptance, and about our present staff. We settle with him on something called Flexibility so that--maybe--some day-- we can change . . . He draws collections of classrooms--the same old eggcrates with new doodads: student commons, centrally served cafeterias, television sets in the auditorium, a language laboratory. But that's not The New High School...[1]

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[1] Archibald B. Shaw and Linn Smith, "The New High School," Educational Executives' Overview, 3: 33-48 (March, 1962). p. 34.

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APPENDICES

APPENDIX A

REFERENCE DATA SHEET

1. THE PROBLEM

TYPE OF PUBLICATION

☐ Book
☐ Magazine
☐ Pamphlet
☐ Monograph
☐ Other

A. Motivating Factor:

☐ Product Research
☐ Consultant Service
☐ Job Related
☐ Dissertation
☐ Professional Advancement
☐ Research qua Research
☐ Other ______________________________

B. Focus:

2. THE DESIGN

A. Method of Research:

☐ Historical
☐ Experimental
☐ Descriptive
  ☐ Survey
  ☐ Causal
  ☐ Case-Study
  ☐ Follow-up
  ☐ Documentation
  ☐ Trend
☐ Other ______________________________

B. Population ______________________________

____

C. Techniques of Collecting Data:

D. Statistical Methods:

3. FINDINGS AND CONCLUSIONS

A. Nature of the Findings:

B. Agreement or Disagreement Between Educators and Architects:
☐ Agree
☐ Disagree
☐ No Conflict Indicated
☐ Other ______________________________

C. Generalizability:

☐ Not Generalizable
☐ Generalizable to ______________________________
☐ Other ______________________________

D. Implications:

REFERENCE DATA SHEET

—2—

4. SOURCES

A. Researcher(s):

- ☐ Education
  - ☐ Professor
  - ☐ Graduate Student
  - ☐ Consultant
  - ☐ Administrator
  - ☐ Other ____________

- ☐ Architecture
  - ☐ Architect
  - ☐ Engineer (P.L.)
  - ☐ Related Technician
  - ☐ Staff Writer
  - ☐ Professor
  - ☐ Graduate Student
  - ☐ Other ____________

- ☐ Education
  - ☐ Professor
  - ☐ Graduate Student
  - ☐ Consultant
  - ☐ Administrator
  - ☐ Other ____________

- ☐ Architecture
  - ☐ Architect
  - ☐ Engineer (P.L.)
  - ☐ Related Technician
  - ☐ Staff Writer
  - ☐ Professor
  - ☐ Graduate Student
  - ☐ Other ____________

B. Institution or Place ______________________________

- ☐ College or University
- ☐ Private Practice
- ☐ Foundation
- ☐ Industrial
- ☐ Professional
- ☐ Other ____________

C. Support ______________________________

- ☐ Foundation
- ☐ College or University
- ☐ Private
- ☐ Unsponsored
- ☐ Professional Organization
- ☐ Federal Government
- ☐ State Government
- ☐ City or Local School District
- ☐ Industry (Product Promotion)
- ☐ Industry (Unencumbered)
- ☐ Other ______________________________

APPENDIX B

SORTING CARD

ED OR ARCH	APP, NON-APP, R	RES OR REL

_____ Sort 1. PUBLICATION______________________________

____

_____ Sort 2. VOLUME____________________ YEAR(S)______

_____ Sort 3. PAGES____________________

_____ Sort 4. AUTHOR(S)______________________________

____

_____ Sort 5. TITLE______________________________

____

APPENDIX C - PILOT PROJECT INSTRUMENT

Dear Associate:

As you are probably aware of as a result of the department seminar, I am trying to develop an instrument that will assist me in selecting items of research in the school plant field. I am seeking your assistance in establishing the reliability of the instrument that has been worked out to do this task. Using the attached instrument for reporting research characteristics of selected articles from periodicals should take only a short period of your time and will be greatly appreciated by me.

There are ten accompanying duplicated articles and ten columns on the instrument. Please place an X in each blank space when you find the described characteristic to be present in the article. Since the purpose of this trial run is to establish reliability, it is essential that you check the characteristics with as much care as possible and that you evaluate each article on all ten characteristics and also on the final YES-NO item for each article. If a characteristic is not represented in the article, leave the space blank. Bear in mind that the articles may not necessarily be research; the range of characteristics per article may run from none to a large proportion of the ten characteristics.

Most of the characteristics will be very familiar to you and should be viewed in terms of your bakcground and understanding of the field of educational research. If you have a question, do not hesitate to ask it. Thank you very much for your assistance.

Ross R. Papke

THE ARTICLE (PUBLICATION) IS CHARACTERIZED AS FOLLOWS:	ARTICLE 1	ARTICLE 2	ARTICLE 3	ARTICLE 4
1. The problem is clearly defined (in terms of hypothesis(s) or general statement).	____	____	____	____
2. The related literature is reviewed and documented with at least six references.	____	____	____	____
3. The population studied is explictly defined.				
4. The study is based on expert opinion.	____	____	____	____
5. The study is based on survey data.	____	____	____	____
6. The study is based on case study(ies).	____	____	____	____
7. The study is based on experimental investigation.	____	____	____	____
8. The study utilizes theoretical constructs (concepts).	____	____	____	____
9. The results of the study are generalizable.	____	____	____	____
10. The study can be replicated by another investigator.	____	____	____	____

Ignoring for a moment the above list of characteristics, does the article or publication in your judgment qualify to be classified as research? (Please circle YES or NO)	YES NO	YES NO	YES NO	YES NO

CONTINUED

ARTICLE 4	ARTICLE 5	ARTICLE 6	ARTICLE 7	ARTICLE 8	ARTICLE 9	ARTICLE 10
____	____	____	____	____	____	____
____	____	____	____	____	____	____
____	____	____	____	____	____	____
____	____	____	____	____	____	____
____	____	____	____	____	____	____
____	____	____	____	____	____	____
____	____	____	____	____	____	____
____	____	____	____	____	____	____
____	____	____	____	____	____	____
YES	YES	YES	YES	YES	YES	YES
NO	NO	NO	NO	NO	NO	NO

APPENDIX D - NUMERICAL RESULT O

THE ARTICLE (PUBLICATION) IS CHARACTERIZED AS FOLLOWS:	ARTICLE 1	ARTICLE 2	ARTICLE 3	ARTICLE 4
1. The problem is clearly defined (in terms of hypothesis(s) or general statement).	12	4	24	26
2. The related literature is reviewed and documented with at least six references.	0	0	24	3
3. The population studied is explictly defined.	1	5	23	13
4. The study is based on expert opinion.	22	5	3	5
5. The study is based on survey data.	0	3	9	0
6. The study is based on case study(ies).	1	12	4	7
7. The study is based on experimental investigation.	1	1	18	24
8. The study utilizes theoretical constructs (concepts).	4	0	4	12
9. The results of the study are generalizable.	3	2	17	20
10. The study can be replicated by another investigator.	3	3	25	25
Ignoring for a moment the above list of characteristics, does the article or publication in your judgment qualify to be classified as research? (Please circle YES or NO)	YES 1 NO 25	YES 0 NO 26	YES 26 NO 0	YES 23 NO 3

ESULT OF PILOT PROJECT

CLE 4	ARTICLE 5	ARTICLE 6	ARTICLE 7	ARTICLE 8	ARTICLE 9	ARTICLE 10
6	23	15	13	6	9	15
3	1	1	1	1	1	1
3	8	1	11	1	1	19
5	11	19	8	16	15	9
0	13	4	7	1	1	3
7	1	1	15	0	3	12
24	6	1	7	4	0	9
12	9	1	5	10	6	2
20	19	3	12	7	3	8
25	16	3	14	5	3	14
ES 23	YES 14	YES 2	YES 11	YES 4	YES 1	YES 11
O 3	NO 12	NO 24	NO 15	NO 22	NO 25	NO 15

APPENDIX E - PERCENTAGE SUMMARY

THE ARTICLE (PUBLICATION) IS CHARACTERIZED AS FOLLOWS:	ARTICLE 1	ARTICLE 2	ARTICLE 3	ARTICLE 4
1. The problem is clearly defined (in terms of hypothesis(s) or general statement).	46%	15%	92%	100%
2. The related literature is reviewed and documented with at least six references.	0%	0%	92%	12%
3. The population studied is explictly defined.	4%	19%	88%	50%
4. The study is based on expert opinion.	85%	19%	12%	19%
5. The study is based on survey data.	0%	12%	35%	0%
6. The study is based on case study(ies).	4%	46%	15%	27%
7. The study is based on experimental investigation.	4%	4%	69%	92%
8. The study utilizes theoretical constructs (concepts).	15%	0%	15%	46%
9. The results of the study are generalizable.	12%	8%	65%	77%
10. The study can be replicated by another investigator.	12%	12%	96%	96%
Ignoring for a moment the above list of characteristics, does the article or publication in your judgment qualify to be classified as research? (Please circle YES or NO)	YES 4% NO 96%	YES 0% NO 100%	YES 100% NO 0%	YES 88% NO 12%

AGE SUMMARY OF PILOT PROJECT

ARTICLE 4	ARTICLE 5	ARTICLE 6	ARTICLE 7	ARTICLE 8	ARTICLE 9	ARTICLE 10
100%	88%	58%	50%	23%	35%	58%
12%	4%	4%	4%	4%	4%	4%
50%	31%	4%	42%	4%	4%	73%
19%	42%	73%	31%	62%	58%	35%
0%	50%	15%	27%	4%	4%	12%
27%	4%	4%	58%	0%	12%	46%
92%	23%	4%	27%	15%	0%	35%
46%	35%	4%	19%	38%	23%	8%
77%	73%	12%	46%	27%	12%	31%
96%	62%	12%	54%	19%	12%	54%
YES 88% NO 12%	YES 54% NO 46%	YES 8% NO 92%	YES 42% NO 58%	YES 15% NO 85%	YES 4% NO 96%	YES 42% NO 58%

APPENDIX F - HIGH AGREEMENT CHART

THE ARTICLE (PUBLICATION) IS CHARACTERIZED AS FOLLOWS:	ARTICLE 1	ARTICLE 2	ARTICLE 3	ARTICLE 4
1. The problem is clearly defined (in terms of hypothesis(s) or general statement).		☐	☐	☐
2. The related literature is reviewed and documented with at least six references.	☐	☐	☐	☐
3. The population studied is explictly defined.	☐	☐	☐	
4. The study is based on expert opinion.	☐	☐	☐	☐
5. The study is based on survey data.	☐	☐		☐
6. The study is based on case study(ies).	☐		☐	
7. The study is based on experimental investigation.	☐	☐		☐
8. The study utilizes theoretical constructs (concepts).	☐	☐	☐	
9. The results of the study are generalizable.	☐	☐		
10. The study can be replicated by another investigator.	☐	☐	☐	☐
Ignoring for a moment the above list of characteristics, does the article or publication in your judgment qualify to be classified as research? (Please circle YES or NO)	YES NO	YES NO	YES NO	YES NO

T MENT CHART (LESS THAN 20% OR MORE THAN 80%)

ARTICLE 4	ARTICLE 5	ARTICLE 6	ARTICLE 7	ARTICLE 8	ARTICLE 9	ARTICLE 10
☐	☐	___	___	___	___	___
☐	☐	☐	☐	☐	☐	☐
___	___	☐	___	☐	☐	___
☐	___	___	___	___	___	___
☐	___	☐	___	☐	☐	☐
___	☐	☐	___	☐	☐	___
☐	___	☐	___	☐	☐	___
___	___	☐	☐	___	___	☐
___	___	☐	___	___	☐	___
☐	___	☐	___	☐	☐	___
YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

APPENDIX G - LOW AGREEMENT CHART (20%

THE ARTICLE (PUBLICATION) IS CHARACTERIZED AS FOLLOWS:	ARTICLE 1	ARTICLE 2	ARTICLE 3	ARTICLE 4
1. The problem is clearly defined (in terms of hypothesis(s) or general statement).	☐	___	___	___
2. The related literature is reviewed and documented with at least six references.	___	___	___	___
3. The population studied is explictly defined.	___	___	___	☐
4. The study is based on expert opinion.	___	___	___	___
5. The study is based on survey data.	___	___	☐	___
6. The study is based on case study(ies).	___	☐	___	☐
7. The study is based on experimental investigation.	___	___	☐	___
8. The study utilizes theoretical constructs (concepts).	___	___	___	☐
9. The results of the study are generalizable.	___	___	☐	☐
10. The study can be replicated by another investigator.	___	___	___	___
Ignoring for a moment the above list of characteristics, does the article or publication in your judgment qualify to be classified as research? (Please circle YES or NO)	YES NO	YES NO	YES NO	YES NO

RT (20% TO 80% JUDGMENT RANGE)

ICLE 4	ARTICLE 5	ARTICLE 6	ARTICLE 7	ARTICLE 8	ARTICLE 9	ARTICLE 10
___	___	☐	☐	☐	☐	☐
___	___	___	___	___	___	___
☐	☐	___	☐	___	___	☐
___	☐	☐	☐	☐	☐	☐
___	☐	___	☐	___	___	___
☐	___	___	☐	___	___	☐
___	☐	___	☐	___	___	☐
☐	☐	___	___	☐	☐	___
☐	☐	___	☐	☐	___	☐
___	☐	___	☐	___	___	☐
ES	~~YES~~	YES	~~YES~~	YES	YES	~~YES~~
O	~~NO~~	NO	~~NO~~	NO	NO	~~NO~~

APPENDIX H - EVALUATION SHEET

Dear Associate:

Thank you very much for your prior assistance with my instrument intended to select research in the school plant field. The instrument worked out well with but a few minor difficulties. I am now attempting to work out these difficulties by asking a few of the people that reacted to the instrument to tell me if they experienced confusion with the wording of the description of the characteristics. If you will, please look over the material below and note your comments as prescribed.

A. With reference to the articles originally rated, did you experience more than average difficulty in judging whether or not the following articles qualified to be classified as research? (Please circle YES or NO)

ARTICLE 5: YES NO   ARTICLE 7: YES NO   ARTICLE 10: YES NO

B. With reference to the articles originally rated, did you experience more than average difficulty in assessing the characteristics for (Please circle YES or NO):

ARTICLE 5: YES NO   ARTICLE 7: YES NO   ARTICLE 10: YES NO

C. If you indicate that you did experience some difficulty with one or more of the articles in item B above, please indicate below what changes you feel would make the statements of characteristics more clearly discriminatory. Eight of the statements of characteristics are presented below. Please cross out or change words or phrases, or, rewrite the statement in the blank provided, or, comment on the statement, in order to make it more discriminative:

1. The problem is clearly defined (in terms of hypothesis(s) or general statement). 1. ______________________________

3. The population studied is explictly defined. 3. ______________________________

4. The study is based on expert opinion. 4. ______________________________

5. The study is based on survey data. 5. ______________________________

6. The study is based on case study(ies). 6. ______________________________

7. The study is based on experimental investigation. 7. ______________________________

9. The results of the study are generalizable. 9. ______________________________

10. The study can be replicated by another investigator. 10. ______________________________

APPENDIX I - FINAL INSTRUME

	ARTICLE	ARTICLE	ARTICLE	ARTICLE
1. The problem is clearly stated as a hypothesis(es) to be tested or as a question(s) to be researched.	___	___	___	___
2. The related literature is reviewed and documented with at least six references.	___	___	___	___
3. The population (or a population sample) investigated is explictly defined.	___	___	___	___
4. The report includes the collection and analysis (or synthesis) of expert opinion.	___	___	___	___
5. The report utilizes the collection and analysis (or synthesis) of survey data.	___	___	___	___
6. The report includes the collection and analysis (or synthesis) of data pertaining to a case study(ies).	___	___	___	___
7. The report utilizes an experimental design and control.	___	___	___	___
8. The report utilizes theoretical constructs (concepts).	___	___	___	___
9. The investigator explictly indicates how and to what related problems the results may (or may not) be generalized.	___	___	___	___
10. From the information reported, the procedure of the investigation may be replicated by another researcher.	___	___	___	___

NAL INSTRUMENT

ARTICLE	ARTICLE	ARTICLE	ARTICLE	ARTICLE	ARTICLE	ARTICLE
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APPENDIX J

CLASSIFIED GUIDE TO REFERENCES IN THE PERIODICAL LITERATURE

1955-1964

OUTLINE

- 1000 GENERAL INFORMATION
  - 1010 State and National Trends
  - 1020 Research Facilities and Programs
- 2000 EDUCATIONAL NEEDS
- 3000 FINANCING SCHOOL PLANT
  - 3010 Cost and Finance
  - 3020 Cost Comparisons
  - 3030 Economies
- 4000 ORGANIZING FOR PLANNING
  - 4010 Planning Procedures
  - 4020 Community Involvement
  - 4030 Architect--Selection and Relations
  - 4040 Consultant Services
- 5000 PLANNING NEW SCHOOL PLANTS
  - 5010 Sites
  - 5020 Educational Specifications
  - 5030 Building Layout
  - 5040 Standardized Construction and Modular Planning
  - 5050 Flexibility
  - 5060 Size and Capacity
  - 5070 Building Materials
  - 5080 General Planning and Design Factors
  - 5090 Environmental Considerations
    - 5091 Spatial
    - 5092 Thermal
    - 5093 Sonic
    - 5094 Esthetic
    - 5095 Visual
    - 5096 General Environment
  - 5100-5110 Special Purpose Planning--Instruction
    - 5101 Instructional Materials Area and Library
    - 5102 Shop and Agriculture
    - 5103 Gym, Physical Education, and Pool
    - 5104 Music
    - 5105 Business Education
    - 5106 Home Economics
    - 5107 Multipurpose
    - 5108 Art
    - 5109 Special Education

5111 Language Laboratory
5112 Science Facilities
5113 Social Studies Facilities
5114 Large and Small Group Instruction and Team Teaching
5120 Special Purpose Planning--Auxiliary to Instruction
5121 Auditorium and Theater
5122 Cafeteria and Kitchen
5123 Guidance
5124 Central Office
5130 Special Purpose Planning--Other Considerations
5131 Audiovisual
5132 Safety
5133 Non-Instructional Space
5134 Fallout Shelters

6000 CONSTRUCTION

7000 EVALUATION

8000 MISCELLANEOUS
8010 Remodeling and Additions
8020 Portable, Demountable and Prefabricated Structures

9000 PORTFOLIO OF SCHOOLS

1000 GENERAL INFORMATION

1010 State and National Trends

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